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Research Article

The Effect of the Fetal Head Station at Epidural Placement on the Labor Outcome

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ABSTRACT

Background: The fetal head station plays a crucial role in determining its location in the birth canal, estimating the time and manner of delivery, and detecting the upcoming steps in both the fetus and mother. This information helps medical staff deal with these steps more accurately and effectively. The aim of this study is to determine the effect of the fetal head station at epidural placement on the labor outcome.

Methods: Based on the inclusion criteria, we selected 234 healthy women, all of whom requested and received epidural analgesia. Before inserting the epidural, we made a list of all the signs of labor. Next, 16 ml of 0.125% isobaric bupivacaine mixed with 50 micrograms of fentanyl was injected into the samples to make labor painless. Blood pressure, O_2 saturation, and heart rhythm of the samples (mothers) were measured non-invasively every 5 minutes (first half an hour) and also every quarter of an hour, and careful monitoring was performed by the treatment team. The treatment team also performed fetal heart monitoring. We recorded other parameters as well. Data were analyzed using chi-square and one-way ANOVA tests. We considered a P-value of less than 0.05 as the threshold of significance.

Results: In total, 234 women received epidural analgesia; most had normal deliveries (198), and only 36 of them had cesarean sections. no significant relation between both station and mode of delivery, by using a chi-square test with a range of (P value = 0.4581). The relationship between station and cervical dilation between groups is significant (P = 0.0147). The duration of the labor procedure between station groups is significant (P value = 0.0005).

Conclusion: Fetal head station usage for determining epidural analgesia start for women in labor shows more accuracy than using cervical dilation alone; epidural analgesia helps the labor procedure to be less painful, has a minimal effect on labor duration, and helps increase the rate of normal delivery.

Introduction

The process of labor involves the delivery of the fetus and placenta from the uterus through the vagina. Three stages further divide the process; successful labor hinges. on three factors: maternal effort and uterine contraction, fetal characteristics, and pelvic anatomy. The labor procedure can be extremely painful for women in labor, influenced by some factors including participating in childbirth preparation classes, parity, and use of oxytocin. Serial cervical examination is used to determine cervical dilation, effacement, and station [1-2]. Epidural analgesia (EA) is widely used to relieve labor

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pain, but there is controversy about the effect of epidural analgesia on the duration of labor and the appropriate time to administer it [3]. Previously, the most common method for detecting labor progress and initiating analgesia was cervical dilation. However, fetal head stations have a crucial role in detecting the stages of fetal position that help detect the upcoming steps in both the fetus and mother, which helps medical staff to deal with them more accurately and effectively. Unfortunately, there is not enough research in recent years supporting the effectiveness of FHS in labor progression.

The fetal head station (FHS), assessed using digital vaginal assessments, indicates the level of the fetal head in the birth canal. There are classification systems for determining fetal stations. They show how far the leading edge of the bone is from the ischial spines in centimeters (-5 to +5 and -3 to +3). The midpoint (zero station) is found at the ischial spines of the mother, which is also known as fetal head engagement [4]. Some investigators suggest that epidural analgesia should be given only when the cervix is dilated to >4 centimeters or when the fetal head is fully developed. In contrast, other investigators suggest that early initiation of epidural analgesia does not prolong labor or increase the rate of cesarean delivery [5]. However, women in the trimester before labor begins or when labor is not progressing (fetal head not presenting through the birth canal) are candidates for cesarean section [6-7]. However, it is considered most effective when women in labor request the epidural, and it is regarded as the green signal to start analgesia.

In our study, we aim to utilize the fetal head station in conjunction with cervical dilation to determine the appropriate timing for initiating epidural analgesia, monitor the progression of labor, and determine the mode of delivery (normal vaginal delivery or cesarean section). Also see the accuracy of epidural placement and the duration of the labor procedure.

Methods

In this study, we used the fetal head station in conjunction with cervical dilation to initiate epidural analgesia. The participants in this study were women aged 18 to 40 years hospitalized in Arash Hospital. Inclusion criteria in this study included willingness to have an epidural, gestational age of 34 to 42 weeks, first delivery, ASA class 1 and 2, nulliparous with labor pain, planning for vaginal delivery, and having a viable single fetus with a vertex presentation. Also, women who had heart problems, liver disease, severe bronchial asthma, pre-eclampsia, morbid obesity, a history of pelvic trauma, diabetes, chronic high blood pressure, opioid drug use in the last six hours, coagulation disorders, skin infections, or spinal abnormalities were not allowed to participate.

The Clinical Trial Registry registered it under the identifier IR.TUMS.SPH.REC.1403.016, which is an ethical code. All the patients provided informed consent.

The samples included 234 healthy women (ASA class 1 and 2). The pre-hydration process involved injecting 500 ml to 1 liter of Ringer-lactate solution. Next, we used an 18-gauge needle (Medikit, Gurgaon, India) to locate the epidural space in the interspace below L2, ensuring there was no air resistance. Mothers were given a test dose of 1.5% lidocaine (3 milliliters) with 1:200,000 epinephrine. Patients were closely monitored. A second dose of 0.125 percent isobaric bupivacaine in 50 μg fentanyl was given to patients if the test dose was negative (if the mother's heart rate rose by 20% 20 minutes after the test injection) and the drug was given intrathecally (no signs of motor block were seen after 3 minutes). While the patients were in a sitting position, a 20-gauge catheter and closed Tip-3 lateral eyes (Medikit, Gurgaon, India) were inserted and secured in the epidural space. The patients were then placed in the supine position with the left uterus displaced. The next step was to inject 16 ml of 0.125% isobaric bupivacaine mixed with 50 micrograms of fentanyl into the samples to make them less painful during labor. Blood pressure, O_2 saturation, and heart rhythm of the samples (mothers) were measured non-invasively every 5 minutes (first half an hour) and also every quarter of an hour, and careful monitoring was performed by the treatment team. The treatment team also performed fetal heart monitoring. Other parameters such as pain score (according to the patient's statement), motor block (using the Bromage questionnaire), sensory level (using the pinprick method), maternal blood pressure and heart rate, fetal heart rate, labor progress, and any maternal complaints or side effects were recorded. Mothers who complained of pain greater than a score of four (VAS) and were willing to receive medication were given a dose (5-16 ml) of the initial solution (epidural) provided that labor was not imminent. We asked the patients about the onset of pain relief after the drug injection. The time of the active phase of labor and phases 1 and 2, as well as the rate of CS and natural spontaneous delivery (NSD), were recorded and analyzed. We also recorded the Apgar scores during the first and fifth minutes of labor. We analyzed the data using chi-square and one-way ANOVA tests. We considered a P-value of less than 0.05 as the threshold of significance.

Results

In total, 234 women received epidural analgesia; most had normal deliveries (198), and only 36 of them had cesarean sections. no significant relation between both station and mode of delivery, by using a chi-square test with a range of (P value = 0.4581) (Table 1). The relation between station and cervical dilation between groups is

significant (P value=0.0147) (Table 2). The duration of the labor procedure between station groups is significant (P value = 0.0005) (Table 3).

Table 1- Mode of delivery and station

Mode of Delivery	**Station**			
	-1*	**-2****	**-3*****	**Total**
NVD	46	29	123	198
	23.23	14.65	62.12	100.00
Cesarean	5	6	25	36
	13.89	16.67	69.44	100.00
Total	51	35	148	234
	21.79	14.96	63.25	100.00
Pearson Chi2 = 1.56, P value = 0.4581				

First row has frequencies and second row has row percentagesz*(1 cm above pelvis), **(2 cm above pelvis), ***(3 cm above pelvis)

Table 2- Station and Cervical Dilation

Station		**Summary of cervical Dilation**			
		Mean ± Std. dev			**Freq.**
1 cm above the pelvis		5.25 ± 1.23			51
2 cm above the pelvis		4.74 ± 1.24			35
3 cm above the pelvis		4.70 ± 1.14			148
Total		4.83 ± 1.19			234
Source	SS	df	MS	F	P value
Between groups	11.8714854	2	5.93574272	4.30	0.0147
Within groups	318.790908	231	1.38004722		
Total	330.662393	233	1.4191519		
Cervical Dilation	P value				
2 vs 1	0.118				
3 vs 1	0.012				
3 vs 2	0.982				

Table 3- The relation between station and summary of duration

Station			**Summary of duration**		
			Mean ± Std. dev.		**Freq.**
1 cm above the pelvis			106.96078 ± 83.570799		51
2 cm above the pelvis			151.71429 ± 122.65412		35
3 cm above the pelvis			183.61486 ± 129.86364		148
Total			162.13675 ± 123.73188		234
Source	**SS**	**df**	**MS**	**F**	**P value**
Between groups	227339.512	2	113669.756	7.86	0.0005
Within groups	3339792.11	231	14457.9745		
Total	3567131.62	233	15309.5778		
duration	**P value**				
2 vs 1	0.209				
3 vs 1	0.000				
3 vs 2	0.337				

Discussion

Our study included 234 pregnant women who underwent labor with fetal head station use for epidural analgesia placement, with 198 of them having painless normal delivery and considering successful epidural analgesia, and 36 having cesarean section delivery. Hung et al. (2015) concluded in their cohort study that epidural analgesia has an effect on the mode of delivery in both nulliparous and multiparous women [8]. In contrast, Sheiner et al. (1999) stated that the station of the fetal head while initiating epidural analgesia does not affect the mode of delivery, so there is no justification for delaying epidural analgesia in labor until the presenting fetal part is engaged [5]. Our study backs up the later essay because the position of the fetal head doesn't affect the mode of delivery; EA could start early or late, and most women had normal deliveries no matter where the fetal head was located. Of the women whose labors went

smoothly, 123 (62.12%) had theirs at station -3 (3 cm above the pelvis), 29 (14.69%) had theirs at station -2, and 46 (23.23%) had theirs at station -1 (1 cm above the pelvis). All of their labors went smoothly and the painkillers didn't wear off.

In 2021, research suggested that cervical dilation of 6 cm should be the threshold for active labor, then epidural analgesia start is effective, by Zha et al., but there is a limitation in their study as their evidence was solely coming from randomized control trials [3]. We looked at the starting point for epidural analgesia when the cervix was dilated. This gave us a more accurate result, showing that we didn't have to wait until the cervix reached a certain diameter as long as the station wasn't more than 3 cm above the pelvis. It could be in the first or second stages of labor or whenever the woman in labor asks for analgesia.

In 2015, Anwar et al. did a study that said epidural analgesia does extend the first stage of labor and the rate of instrumental delivery [9]. We found that epidural analgesia and labor duration were longer in cesarean sections than in normal deliveries, but we only had a few CS patients compared to the higher rate of normal deliveries. In previous studies, authors agreed that the best time to start epidural analgesia is when a woman in labor requests it. However, some experts argue that starting epidural analgesia before a cervical dilation of less than 4 cm may lead to a longer labor duration. In our study, we concluded that women who received epidural analgesia in station -3 (3 cm above the pelvis) had their labor duration slightly longer than those in station -1 (1 cm above the pelvis) ($P<0.000$), but in stations -2 and -1, the number was not effective; still, all went through normal delivery without any instrumental procedure.

Conclusion

Fetal head station usage for determining epidural analgesia start for women in labor shows more accuracy than using cervical dilation alone; epidural analgesia helps the labor procedure to be less painful, has a minimal effect on labor duration, and may increase the rate of normal delivery.

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