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Nurse-Led Educational Intervention on Maternal Repositioning in Reducing Variable Fetal Heart Rate Deceleration

Attiya Sultana[1], Iqra Saleem[2]*, Adnan Yaqoob[3]

[1]MSN Scholar, Lahore School of Nursing, The University of Lahore, Punjab, Pakistan
[2]*Assistant Professor, Lahore School of Nursing, The University of Lahore, Punjab, Pakistan
[3] Professor /Head of Department, Lahore School of Nursing, The University of Lahore, Punjab, Pakistan
*Corresponding Authors: Iqra Saleem, Email: iqra.saleem@lsn.uol.edu.pk

ABSTRACT: **Background**: Variable Decelerations is an abnormal fetal heart rate patterns and it is related to umbilical cord compression, and it needs immediate medical attention.

Objective: The purpose of this study was to assess the effect of nurse-led educational intervention on nurses' knowledge regarding fetal heart rate monitoring, interpretation and repositioning of the mother in the care of variable fetal heart rate deceleration during child birth.

Methodology: A Pre–post Quasi-experimental study was carried out in Gynecology Department of Nawab Sir Sadiq Abbasi Hospital, Bahawalpur. A total of 46 registered nurses were recruited in the study using convenient sampling technique. A preliminary and follow-up structured 25 item nurses' knowledge questionnaire about FHR monitoring, normal baseline FHR, FHR variability, early and late decelerations, variable deceleration, cardiotocography, VEAL-CHOP, maternal repositioning, nursing interventions, reassessment, documentation and fetal response was administered pre and post educational intervention.

Results: Mean FHR was found to decrease from baseline 145.92 ± 18.37 to 130.58 ± 19.77 after interventions ($t = 5.812$; $p < 0.001$). The mean knowledge score was significantly higher after the intervention at 96.89 ± 5.19 compared to pre-intervention at 54.80 ± 5.77. Statistically significant difference was found by Wilcoxon signed ranks test ($Z = -5.907$, $p < 0.001$).

Conclusions: The overall results of the study suggest that maternal repositioning is a safe, cost effective and clinically useful intervention and nurse led educational programs are highly effective in improving knowledge and practice. Ongoing education and training, therefore, are necessary to improve clinical competence and maternal & fetal outcomes.

INTRODUCTION

Fetal health is one of the major concerns in the obstetric care. Monitoring the fetal heart rate during labor is vital component in obstetric care, since it helps assess the condition of the fetus (1). Abnormalities in the fetal heart rate highlight various complications such as risk of oxygen deficiency, low blood pH, brain injury and neurological injuries, if this issue is not properly address than it may lead to severe consequences in future (2,3).

Electronic fetal monitoring may spot tachycardia, bradycardia, late decelerations, prolonged decelerations and variable decelerations in an unborn baby (4). Among all these complications variable decelerations is the most common complication which are commonly reported in the active phase of labor (5).

A sudden drop in FHR is commonly known as a variable deceleration and is related to the umbilical cord being compressed during labor. Variable decelerations involve a sudden and significant lowering of the FHR and this change in heartbeat may differ in each case by its length, level and time in relation to uterine contractions (6). While most of the time they are harmless, a pattern of multiple variable decelerations might cause fetal distress, rise in cesarean rates and problems in newborn babies. These decreases are common during labor and if left unmanaged, might cause distress to the fetus (7).

If a woman has several episodes of variable decelerations, her baby might get less oxygen, suffer from acid buildup and face an increased chance of having a cesarean delivery or a procedure during birth. So, identifying and resolving the concern with gentle procedures is necessary to get fetal oxygenation back to normal (8).

According to existing guidelines, healthcare professionals may try using several non-medication interventions to ease cord compression, for example, repositioning the mother, inserting fluid around the baby and providing oxygen (9). Among these options, changing the mother's position to release compression in the umbilical cord is simple, painless, budget-friendly and helps reduce fetal distress (10). Common repositioning techniques include lateral positioning (left or right), knee-chest position, or Trendelenburg positioning, which may help relieve cord compression by altering fetal and maternal anatomical dynamics (11,12). Literature also emphasized on the effectiveness of maternal repositioning and in decompression of fetal umbilical cord. According to one of the studies maternal repositioning is very effective in reducing variable deceleration (13).

During fetal monitoring, variable deceleration (VDs) are common and these changes in the heartbeat are usually caused by the compression of the umbilical cord which is very dangerous if the fetus does not getting enough oxygen (14). Unfortunately, when this deceleration becomes severe it may lead to fetal hypoxia, acidosis and a greater risk for urgent procedures in childbirth (15). Even though doctors often propose changing the way mothers lie to relieve their babies from cord compression, the method hasn't been proven to reliably reduce the occurrence of severe variable deceleration.

Many health care professionals from the obstetric care rely on non-invasive techniques that is repositioning such as knee-chest positioning of the mother during pregnancy (16). This approach is typically not used effectively in clinical settings due to a lack of evidence. The lack of standardized protocols and robust experimental studies contributes to uncertainty in clinical decision-making. To explore the effectiveness of the repositioning of the mothers during pregnancy and to eliminate the complications in fetus, it is important to determine whether the repositioning is effective in reduction of variable deceleration.

METHODOLOGY

A Quasi-experimental study was carried out in Nawab Sir Sadiq Abbasi Hospital Bahawalpur following pre-post Quasi-experimental study design. The study includes two populations. Nurses working in the Nawab Sir Sadiq Abbasi hospital were the primary population of the study and laboring women of presented to the gynecology department were the secondary population. Participants in the study were selected convenient sampling technique. Sample size for this study was calculated using Open Epi sample size calculator. With 95% confidence interval, 5% margin of error, 80% power of study and mean group 1 of 0.92 and mean group 2 of 1.31, the calculated sample size of the study is 138 (Cochran, W. G. ,1977) & Dean, A. G.,2010). Eventually, a sample size of 46 were selected from group 1 (Nurses) and 92 were selected from group 2 (Patients).

All the registered nurses with at least six months experience in the gynecology department of the Nawab Sir Sadiq Abbasi hospital were included in the study. Moreover, women with active labor with cervical dilation of ≥4 cm and who experience uterine contraction, with gestation between 37 to 40 weeks and who exhibit variable deceleration measured using electronic fetal monitor were included in the study.

Data were collected using three tools. Fetal heart was monitored using an adopted tool "VEAL CHOP MINE Mnemonic". Also, a 31 items self-structured Perceived Effectiveness Questionnaire was designed to assess the nurse's perception regarding the effectiveness of maternal repositioning and its effect on fetal heart rate. The tools have been validated from fifteen experts and reliability was checked with 10% sample size. A total of 15 experts were involved in context validity index. The overall Content Validity Index (CVI) is 0.88, demonstrating excellent relevance and agreement among expert reviewers. Similarly, reliability of the tool was also assessed using 10% sample population. The reliability analysis reported Cronbach's

alpha in the normal range (Cronbach's alpha=0.807). Nurse's knowledge regarding maternal repositioning and its effect on fetal heart rate was assessed using self-structured Nurses knowledge questionnaire. The reliability analysis reported Cronbach's alpha in the normal range (Cronbach's alpha=0.833) and CVI of 0.90.

The data were gathered in three phases such as pre-intervention, intervention and post interventional. In pre-interventional phase the participants were divided in groups and pre interventional data were collected. The interventional phase was consisting of 8 weeks training sections were in the nurses were trained regarding the techniques of positions and its effectiveness. The post-intervention phase was conducted to evaluate the effectiveness of the program. The same structured questionnaire used during the pre-test was administered as a post-test to all participants to measure improvement in knowledge. The nurses applied the reposition techniques and evaluate the effectiveness of reposition on Variable Decelerations.

RESULTS

The socio-demographic data of participants is presented in the Table 1. The Majority (67.4%) of the participants were from the age group of 39 to 40 years. As for educational qualification, most of the respondents had BSN/Post RN degrees (65.2%). In terms of work experience, 50.0% of participants indicated that they had 5-10 years of experience, 28.3% less than 5 years of experience, and 21.7% more than 10 years.

Table 1: Socio-Demographic Profile of the Nurses, n=46

Demographic Characteristics of Nurses		**Frequency (f)**	**Percentages (%)**
Age	Less than 30 Years	5	10.9%
	30 to 40 Years	31	67.4%
	More than 40 Years	10	21.7%
Gender	Female	46	100.0%
	Male	0	0.0%
Qualification	Diploma Nursing	16	34.8%
	BSN/Post RN	30	65.2%
	MSN	0	0.0%
Working Experience	Less than 5 Years	13	28.3%
	5-10 Years	23	50.0%
	More than 10 Years	10	21.7%

Figure 1 depicting Comparison of Pre and Post overall knowledge. Comparison of Pre and Post overall knowledge was done based on the Low, Fair and Good Knowledge. Before interventions, 42 nurses reported low knowledge about fetal heart and maternal positioning, 4 nurses reported Fair Knowledge and no one reported good knowledge. The nurse's knowledge after the intervention increased and 10 nurses reported Fair knowledge and 36 nurses reported Good knowledge. This figure shows the effectiveness of interventions.

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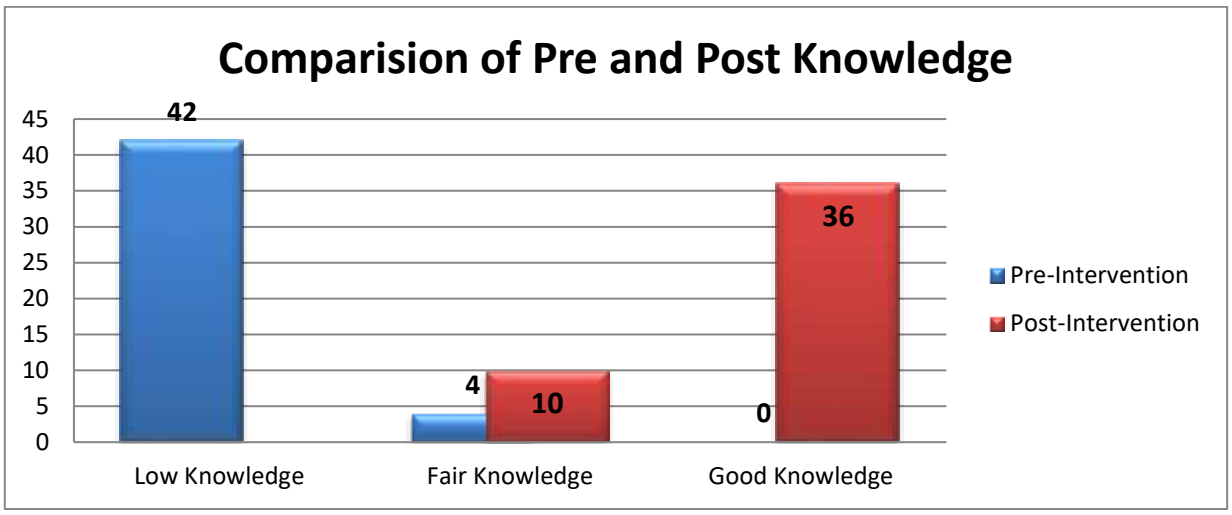


Figure 1: Bar-Chart depicting comparison of pre and post overall knowledge

The data were not normally distributed therefor Wilcoxon Signed Ranks Test was applied to identify the effectiveness of the interventions. The pre intervention mean knowledge of the nurses was 54.80 and after the interventions the mean knowledge enhanced to 96.89. There was a significant (P=0.000) effectiveness of interventions and the knowledge of the nurses enhanced after interventions (Table 2).

Table 2: Effectiveness of Interventions (Pre and Post Interventional Knowledge)

Wilcoxon Signed Ranks Test					
	N	Mean	Std. Deviation	Minimum	Maximum
Pre Interventional Knowledge	46	54.80	5.772	46	69
Post Interventional Knowledge	46	96.89	5.199	84	108
Test Statistics					
			Pre Interventional Knowledge - Post Interventional Knowledge		
Z			-5.907[b]		
Asymp. Sig. (2-tailed)			**.000**		

The clinical and demographic data of the 92 patients is shown in the table 3. As far as age is concerned, most of the participants were aged between 25 and 35years (46.7%). Majority of the participants (69.6%) were at 39 to 40 weeks gestation, while 30.4% were less than 37 to 38 weeks. In terms of BMI, 37.0% of the participants were overweight, 20.7% were obese, 39.1% had normal BMI, and only 3.3% were underweight.

Table 3: Socio-Demographic Profile of the patients, n=92

Demographic Characteristics of Nurses		**Frequency (f)**	**Percent (%)**
Age	Less than 25 Years	35	38.0
	25 to 35 Years	43	46.7

	More than 35 Years	14	15.2
	Total	92	100.0
Gestation	37 to 38 Weeks	28	30.4
	39 to 40 Weeks	64	69.6
	Total	92	100.0
BMI	Under Weight	3	3.3
	Normal	36	39.1
	Overweight	34	37.0
	Obese	19	20.7
	Total	92	100.0

The Wilcoxon Signed Ranks Test analysis showed a significant difference between maternal repositioning (pre) and fetal heart rate (post). Fetal heart rate (FHR) was compared before and after maternal repositioning in 92 participants using Wilcoxon Signed-Ranks Test. After maternal manipulation, the mean FHR was 132.93 ± 14.25 beats per minute, ranging from 110 to 158 beats per minute. The Wilcoxon Signed-Ranks Test showed a significant difference between pre- and post-intervention FHR ($Z = -1.751$, $p = 0.017$) (Table 4).

Table 4: Effectiveness of Maternal reposition and Changes in fetal Heart Rate

Wilcoxon Signed Ranks Test					
	N	Mean	Std. Deviation	Minimum	Maximum
Pre maternal position Fetal Heart Rate	92	139.8478	21.95046	103.00	179.00
Post maternal fetal Heart Rate	92	132.9330	14.24908	110.00	158.00
Test Statistics					
Z			-1.751[b]		
Asymp. Sig. (2-tailed)			.017		
a. Wilcoxon Signed Ranks Test					
b. Based on positive ranks.					

DISCUSSION

The present study was designed to determine the effectiveness of maternal repositioning in fetal heart rate (FHR) and the effect of an educational intervention on the nurses' knowledge. The results showed that fetal heart rate improved significantly after repositioning the mother, and nurses' knowledge increased significantly after repositioning. The current study found that there was a significant difference between the mean fetal heart rate before maternal repositioning (145.92 ± 18.37) and after maternal repositioning (130.58 ± 19.76) ($p < 0.001$). This suggests favorable physiological changes had occurred in the mother's position which benefited the fetus.

Fetal heart rate is considered to be an important indicator of fetal oxygenation and well-being and is also routinely monitored during labor by cardiotocography. An abnormal FHR pattern such as tachycardia or deceleration is usually associated with a decreased uteroplacental circulation. If this is the case, repositioning the mother is suggested as a first-line approach as it increases blood flow to the placenta (18).

A recent study reported that the lateral position for the mother increases uterine-placental perfusion and decreases umbilical compression, which results in better fetal oxygenation (19). This is similar to what was seen in the present study, which reported that there was a significant improvement in the FHR post intervention.

In the similar way, research of the fetal heart rate in the modern era has focused on the importance of maternal position as a determinant of fetal cardiovascular responses. For instance, physiological alterations in maternal posture have been shown to greatly influence fetal heart rate variability and baseline heart rate patterns (20). Therefore, the reduction in FHR in the present study could be due to increased oxygenation and decreased fetal stress.

The present findings are similar to most studies but there is some contradictory evidence. Some reports suggest that maternal repositioning can help normalize FHR patterns, but that it does not always result in changes in neonatal outcomes in high-risk pregnancies. But even the monitoring of the FHR has its limitations, because changes in the FHR do not always correspond to fetal academia (21). This implies that in severe cases, repositioning should be used along with other interventions.

Furthermore, research studies is ongoing to refine the interpretation of FHR through the use of advanced monitoring methods such as computerized analysis of FHR and artificial intelligence models. These technologies provide a greater degree of diagnostic accuracy, but do not supplant simple clinical practices like maternal repositioning (22). Therefore, the results of the present study confirm the importance of simple, non-invasive method in current obstetric care.

The findings of this study are consistent with several recent studies which have focused on maternal repositioning as an effective intervention. For example, lateral positioning has been reported to decrease fetal distress due to an increase in maternal cardiac output and placental perfusion in several studies. These results support the marked decrease in FHR that was seen in this study. Other studies have indicated that effectiveness may vary based on the maternal and fetal condition. In particular, if the hypoxia is extreme or the placenta is insufficient, repositioning alone may not be enough, and other treatments like oxygen or intravenous fluids may be needed (23,24). This brings out an important point where repositioning can be effective but is best combined with a combination of measures.

In addition, traditional studies are concerned with manual interpretation of FHR patterns while newer studies are concerned with automated analysis systems. For example, recent studies based on deep learning models have demonstrated that the continuous monitoring system can detect fetal risk patterns, which is an improvement (25). However, advanced systems are not widely accessible in low-resource areas, and basic interventions, such as maternal repositioning are more important. Therefore, the present study confirms the previous studies and further emphasizes the need for using a combination of traditional and modern techniques in fetal monitoring.

The fact that nurses' knowledge improved from before to after the educational intervention was one of the most important findings of this study. The mean knowledge score increased from 54.80 ± 5.77 to 96.89 ± 5.19, with a statistically significant difference ($p < 0.001$). This is an example of the success of well-designed educational initiatives.

Recent research puts great focus on the need for ongoing professional education in nursing practice, and this is strongly supported by this finding. A study found that nurses are key workers to recognizing abnormal FHR patterns and making prompt interventions, such as positioning the mother. If there are no interventions, there may be a delay in intervention which can lead to adverse fetal consequences if there is a lack of knowledge (26).

Likewise, professional standards emphasize the theoretical knowledge and the clinical training needed to be competent at fetal heart monitoring. Educational programs are then necessary to make sure that the nurse is able to interpret FHR patterns correctly and respond appropriately (27). In contrast, previous research found that many nurses lacked adequate baseline knowledge before training but had a significant improvement in their knowledge after the training. This trend is similar to the results of the present study that confirms the high effectiveness of educational interventions (28). But others have indicated that learning that is not continually reinforced may be forgotten over time. This means that single training sessions may not be enough and on-going re-training courses are required. The present study corroborates this by showing the short-term impact of education, and suggests continuous training.

CONCLUSION

The study findings revealed that the educational intervention by nurses concerning maternal repositioning was very effective in improving both the fetal outcomes and nurse's knowledge. Mean FHR was found to decrease from baseline 145.92 ± 18.37

to after intervention 130.58 ± 19.77 with a mean difference of 15.35, which was statistically significant ($t = 5.812$; $p < 0.001$). This indicates that maternal repositioning is an effective non-invasive intervention for the treatment of variable FHR decelerations. After the intervention, there was a significant increase in knowledge. The mean knowledge score was significantly higher after the intervention at 96.89 ± 5.19 compared to pre-intervention at 54.80 ± 5.77. Statistically significant difference was found by Wilcoxon signed ranks test ($Z = -5.907$, $p < 0.001$), which confirmed that the educational program was very effective in increasing the nurses' knowledge about fetal heart rate monitoring and repositioning of the mother.

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