What are the advantages of clock position method to determine fetal heart axis for inexperienced resident physicians? A comparative study

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Abstract

Objective: Residency training programs are challenging for young physicians with heavy workloads. Although ultrasonography (USG) is an imaging method that is frequently used in obstetrics practice, some basic USG skills can be acquired late in this intensive learning process. Likewise determining the fetal heart axis is an elementary evaluation but can turn into a challenging and time-consuming process, especially for inexperienced clinicians.

Material and Methods: Pregnant women between 20 and 37 weeks of gestation were recruited. Two observers assessed the axis of fetal heart by standard, Bronshtein and clock position methods. Fetal heart axis evaluation times were compared. Inter-observer and intra-observer agreements of the three methods were measured. One factor learning rates were calculated.

Results: A total of 31 pregnant patients between the ages of 18 and 40 years were included in the study. Fetal heart axis evaluation time by the clock position method was shorter than the Bronshtein and standard method in both observers. Furthermore diagnostic accuracy for both observers was 100% with the clock position method, while this fell to 100% in observer-1 and 96.8% in observer-2 using the Bronshtein method. The clock position method was learned faster than either of the other methods.

Conclusion: Clock position method is an easy and feasible method for inexperienced resident physicians in terms of learning and application to determine the fetal heart axis. The advantages of this method increase when patient numbers are higher.
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Keywords: Fetal heart axis, ultrasonography, residency training, fetal situs, learning curve

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Introduction

Residency training programs are challenging for young physicians, due to heavy workloads and the intensive learning process. In obstetrics and gynecology residency programs, inexperience with the use of ultrasonography (USG) equipment and insufficient general obstetrics and gynecology knowledge can cause many mistakes and become a source of stress for young residents (1). For this reason, it is necessary to implement practices that will both reduce the pressure on residents and prevent possible medical errors.

USG is an imaging method that is frequently used in obstetrics practice. Therefore, every obstetrician and gynecologist should improve their USG knowledge and skills. The determination of fetal heart axis using USG is an important step in the detection of fetal cardiovascular diseases and organ malrotation (2). The

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situs of the fetus, extension of the fetal spine, and location of organs, such as the stomach, are necessary for the detection of the fetal heart axis. However, this algorithmic approach can turn into a challenging and time-consuming process, especially for inexperienced clinicians. In addition, it may be more difficult to determine the axis of the fetal heart in cases where other organs are located in different locations (3). In situs inversus cases, for example, diagnosis can be easily missed.

Although basic evaluation of the fetal heart is essential, in most cases it cannot be done properly until the end of the residency program. The fact that fetal heart assessment is relatively difficult is one of the main reasons for this situation, but it is also possible because some basic USG skills can be acquired late in training (4). Likewise, determining the fetal heart axis is also an elementary but time-consuming assessment to be made at the beginning.

There are two known methods to distinguish the fetal heart axis. The standard method is the imagination of fetal heart location after the determination of fetal situs. Another method, described by Bronshtein et al. (5), is based on the clinician's use of his forearm and hand to simulate the fetal situs and then the fetal heart axis. In 2018, Dursun and Aktoz (6) described a new technique to determine fetal heart axis, the clock position method. Since then, the clock position method has been frequently used in our clinic and is preferred, particularly by residents who are new to the program.

The aim of this study was to compare the clock position method with the standard method and the Bronshtein method in terms of ease of learning and application.

Material and Methods

This prospective study was performed in a single clinic, between September and October 2021, and approved by the University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital Local Ethical Committee (approval number: 78, date: 28.04.2021).

Pregnant women, between 20 and 37 weeks of gestation, were included in the study. The demographic information of the patients (age, gestation week, gravidity, parity) who met the inclusion criteria were recorded. Then, the patients were evaluated by transabdominal USG by two residents who had just started the training program and were not trained in fetal heart evaluation. All patients were evaluated by two observers at different times in different rooms. Informed consent was obtained from all participants.

The axis of fetal heart was determined by using three methods, the standard method, the Bronshtein method and the clock position method. Each method was explained to the residents by a senior obstetrician who also recorded evaluation data. Methods were named as the first, second and third method. The order of application of the methods was randomized using a random sequence generator. In order to avoid bias, the residents were not told that one of the methods was first described by the authors (6). Moreover, the authors were not present in the examination room during evaluation.

The first method was distinguishing the fetal heart axis after fetal situs determination, the second method was the technique defined by Bronshtein et al. (5), and the third method was the clock position method (6).

In the Bronshtein method, the clinician is oriented to the fetus using his hand and forearm. The right hand is used for transabdominal evaluation and the left hand is used for transvaginal evaluation. The dorsal side of the forearm represents the fetal back, while the thumb points towards the fetal heart.

In the clock position method, the ultrasonographic transverse plane of the fetus is considered like a clock dial with the fetal vertebrae at 12 o'clock. In the vertex presentation, fetal heart axis is at 5 o'clock. In the breech presentation, fetal heart axis is at 7 o'clock. If the fetus is in transverse situs, the closest part of the fetus to the maternal right side is accepted as the presenting part. Then, the ultrasound probe is rotated 90 degrees and scanned from the maternal right side to the left.

Statistical analysis

Age, gestation week, gravidity and parity are given as median and interquartile range (25^{th}-75^{th} percentile) while presentations were given as number (%) as demographic characteristics of cases. Fetal heart axis evaluation times (seconds) were compared by Friedman test and by Wilcoxon test post-hoc. Inter-observer and intra-observer agreements of the three methods were measured by Cohen's kappa test. One factor learning rates were calculated by Microsoft Excel 2016 (Microsoft Corporation, Redmond, WA, USA) as the reduction of evaluation time when accumulated evaluation is doubled (7). According to this formulation, a low rate was accepted as a better outcome. All statistical analysis were performed using SPSS, version 17.0 (SPSS Inc., Chicago, IL., USA) and a p value <0.05 was considered significant.

Results

Demographic characteristics of the 31 pregnancies are given in Table 1. The most common fetal presentation was vertex (58.1%) followed by breech (25.8%) and transverse (16.1%). Overall fetal heart axis evaluation time via the clock position method was shorter than Bronshtein method and standard method for both observers ($p<0.001$ and $p=0.001$, $p<0.001$ and $p=0.004$, respectively) (Table 2).

The clock position method diagnostic accuracy was 100% in both observers while for the Bronshtein method diagnostic

accuracy was 100% in one and 96.8% in the other. Observer-2 was not able to determine one of the left fetal heart axis via Bronshtein method. There was no discordance between the three methods while Kappa coefficients were 1 for inter-observer and intra-observer agreements.

The clock position method was also learned faster than the standard and Bronshtein methods. As the number of patients increased, the most successful method in terms of time-based effort was the clock position method with the lowest learning curve rate (95.0%, 97.6%, 88.0% for standard, Bronshtein and clock position methods, respectively) (Figure 1).

Discussion

The clock position method was found to be faster to perform than either the standard method or the Bronshtein et al. (5) method to determine the axis of the fetal heart. This result shows that the clock position method may be advantageous for inexperienced clinicians because it saves time and is easy to apply. In addition, the clock position method was the easiest to learn compared to the other methods. Finally, the fetal heart axis was correctly determined in all patients, as with the method of determining fetal heart axis according to fetal situs (the standard method). In the Bronshtein method, however, one observer could not determine the fetal heart axis in one patient.

Although the Bronshtein method has some advantages for determination of fetal heart axis, it does not provide a faster evaluation than the standard method, based on the determination of fetal situs, as seen in this study. Also, if transvaginal evaluation is done, the fact that the clinician's hand to be used for simulation of fetal situs changes and this situation may lead to difficulties. An important advantage of the clock position method is that the practitioner does not have

Table 1. Demographic characteristics of cases

Age (years)	30 (23-36)
Gestation (weeks)	30+0 (26+2-33+6)
Gravidity	3 (1-4)
Parity	0 (0-3)
Presentation	
Vertex	18 (58.1%)
Breech	8 (25.8%)
Transverse	5 (16.1%)
Age, gestation week, gravidity and parity: Median (25^{th}-75^{th} percentile) Presentations: Number (percentage %)	

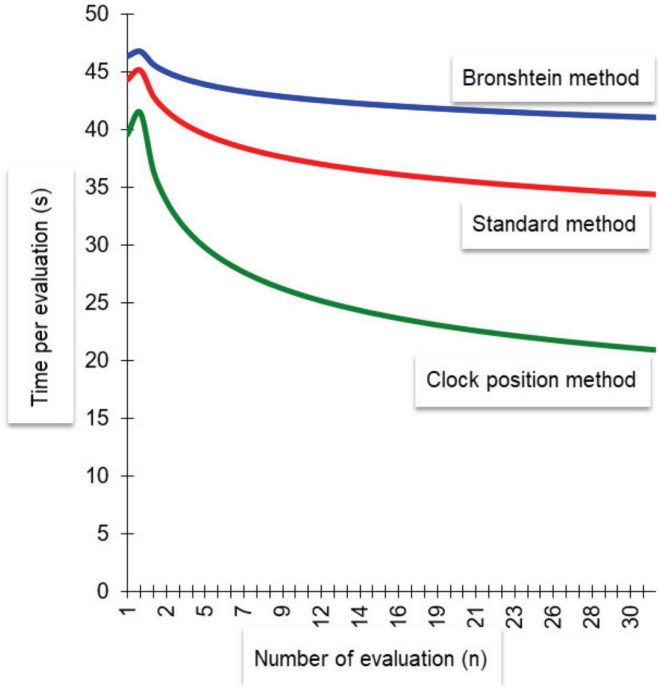

Figure 1. Learning rate curves of three methods

Table 2. Comparison of fetal heart axis evaluation times of three methods

Time (s)	Standard method	Bronshtein method	Clock position method	p
Observer 1				
Vertex (n=18)	16 (12-40)	21 (16-42)	14.5 (10-20)*#	**0.001**
Breech (n=8)	36.5 (23-49.5)	34.5 (19-77.5)	15 (10-31)#	**0.01**
Transverse (n=5)	66 (30.5-106.5)	64 (34-97.5)	32 (15-59.5)#	0.07
Total (n=31)	23 (16-52)	26 (18-49)	16 (10-21)*#	**<0.001**
Observer 2				
Vertex (n=18)	20 (14-35)	32 (25-42)	14 (10-25.5)#	**0.001**
Breech (n=8)	33.5 (12.5-53.5)	41.5 (23-74.5)	16 (11-25)#	**0.028**
Transverse (n=5)	51 (19.5-63)	45 (40.5-94.5)	34 (15-43.5)#	**0.041**
Total (n=31)	21 (14-46)	40 (27-47)*	15 (10-27)*#	**<0.001**
Overall (n=62)	23 (15-47)	35.5 (19-47.5)*	15.5 (10-25.5)*#	**<0.001**
*: p<0.05 when compared with standard method, #p<0.05 when compared with Bronshtein method				

to simulate the fetal position. Mentally conjuring an imaginary clock dial on the fetus is sufficient for the application. Another advantage of the clock position method over the Bronshtein method is that in case the method is forgotten, it is very simple to determine the heart direction according to the fetal situs and then to remember the clock position method. In the Bronshtein method, however, description of the technique should be read again in order to remember the method. Finally, in cases where the fetus is in a vertex presentation, the clinician's arm must be in hyperflexion and forearm must be adjusted according to the back of the fetus while simulating the fetus via the Bronshtein method. This may not be ergonomic for the clinician in some fetal positions. In addition, it may not be appropriate for the clinician to use one arm in this way in front of the patient.

The ease of learning the clock position method is also an important advantage. The challenges experienced by a clinician who has just started residency training are many. In this process, teaching some basic information in a way that is easier to learn renews the residents' self-confidence and enables them to gain practical thinking skills. In addition, the clock position method continues to be easily applicable, not only during the learning phase but also after it is actively used. For all these reasons, we believe that the application of the clock position method in institutions that provide residency training is beneficial.

Study Limitations

This study has strengths and limitations. Prospective design, including residents who do not know fetal heart evaluation, predicting possible bias scenarios to plan the evaluation phase and starting the study by calculating sample size can be listed as strengths. A sample of only two inexperienced residents is the major limitation. Furthermore, due to the small number of patients, fetuses with transverse situs and the low incidence of dextrocardia were also limitations. There is a need for much larger prospective studies to confirm these findings and to validate the clock position method.

Conclusion

We believe that the clock position method is an easy and feasible method for determining the fetal heart axis for inexperienced resident physicians in terms of learning and application.

Ethics Committee Approval: *This prospective study was performed in a single clinic, between September and October 2021, and approved by the University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital Local Ethical Committee (approval number: 78, date: 28.04.2021).*

Informed Consent: *Informed consents were obtained from all participants.*

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