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OPEN ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

Is The Clock Position Method Practical and Accurate to Determine The Axis of The Fetal Heart? Comparison with The Bronshtein (Right-Hand Rule) Method

Saat Pozisyonu Yöntemi, Fetal Kalp Ekseni Belirlemede Pratik ve Doğru Bir Yöntem midir? Bronshtein (Sağ El Kuralı) Yöntemi ile Karşılaştırma

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ÖZET

Amaç: Bu çalışma, birinci yıl kadın doğum asistanları arasında Saat pozisyonu yöntemi ile Bronshtein yöntemi arasındaki fetal kalp aksı belirleme süresi ve doğruluğunu karşılaştırmayı amaçladı.

Gereçler ve Yöntemler: Bu prospektif çalışma, Ankara Etlik Şehir Hastanesi'nde Şubat 2024 - Haziran 2024 tarihleri arasında gerçekleştirildi. Çalışmaya birinci yıl kadın doğum asistanı olan 37 katılımcı dahil edildi. Katılımcılar baş, makat, transvers ve baş (situs inversuslu bir fetus) prezentasyon olmak üzere dört farklı fetal prezentasyon için fetal kalp aksını hem Saat pozisyonu yöntemi hem de Bronshtein yöntemi kullanarak değerlendirdi. Saat pozisyonu yönteminde fetal omurga her zaman saat 12 hizasında olacak şekilde bir saat olarak görüntülenir. Baş gelişte , fetal kalp saat 5 hizasındadır. Makat gelişte, fetal kalp saat 7 hizasındadır. Her iki yontemin değerlendirme süresi ve fetal kalp aksı belirleme doğruluğu kaydedildi.

Bulgular: Saat pozisyonu yöntemi, tüm fetal pozisyonlar için Bronshtein yöntemine kıyasla anlamlı derecede daha hızlıydı ($p < 0,001$). Saat pozisyonu yönteminde en kısa değerlendirme süresi baş prezentasyonda (medyan: 17 saniye, IQR: 11–22), en uzun süre ise situs inversus vakalarında (medyan: 22 saniye, IQR: 15–27) gözlendi. Bronshtein yöntemi, baş prezentasyonda en kısa (medyan: 28 saniye, IQR: 23–38) ve transvers prezentasyonda en uzun (medyan: 76 saniye, IQR: 40–90) süreyi gerektirdi. Saat pozisyonu yöntemi tüm fetal pozisyonlarda %100 doğruluk sağlarken, Bronshtein yöntemi situs inversus vakalarında daha düşük doğruluk oranına sahipti (%81,1).

Sonuç: Saat pozisyonu yöntemi, fetal kalp aksının belirlenmesinde daha hızlı ve daha doğru bir yöntem olup, Bronshtein yöntemine kıyasla daha pratik bir alternatif sunmaktadır. Basit uygulanabilirliği, fetal hareketlerden bağımsız olması ve bilişsel yükü azaltması, özellikle erken dönem kadın doğum asistanları için bu yöntemi değerli kılmaktadır.

Anahtar Kelimeler: Saat pozisyonu yöntemi, bronshtein (sağ el kuralı) yöntemi, fetal kalp, kardiyak aks

ABSTRACT

Objective: This study aimed to compare the evaluation time and accuracy of the Clock position method and the Bronshtein method for determining the fetal heart axis among first-year obstetrics and gynecology residents.

Materials and Methods: This prospective study was conducted at Ankara Etlik City Hospital between February 2024 and June 2024. Thirty-seven first-year obstetrics and gynecology residents evaluated four fetuses with the following presentations: vertex, breech, transverse, and vertex with situs inversus. Each participant determined the fetal heart axis using both the Clock position method and the Bronshtein method. In the Clock position method, the fetal thorax is visualized as a clock, with the fetal spine always positioned at 12 o'clock. In vertex presentation, the fetal heart is located at the 5 o'clock position, whereas in breech presentation, it is at the 7 o'clock position. The evaluation time and the accuracy of fetal heart axis assessment were recorded.

Results: The Clock position method was significantly faster than the Bronshtein method across all fetal positions ($p < 0.001$ for all comparisons). The shortest evaluation time using the Clock method was in the vertex position (17 seconds, 11–22), while the longest was in situs inversus cases (22 seconds, 15–27). In contrast, the Bronshtein method required significantly longer evaluation times, with the shortest duration in the vertex position (28 seconds, 23–38) and the longest in the transverse position (76 seconds, 40–90). The Clock method demonstrated 100% accuracy across all positions, whereas the Bronshtein method showed lower accuracy, particularly in situs inversus cases (81.1%).

Conclusion: The Clock position method is a faster and more accurate approach for fetal heart axis determination than the Bronshtein method. Its simplicity, independence from fetal movements, and reduced cognitive load make it a valuable technique for obstetrics and gynecology residents, particularly those in the early stages of training.

Keywords: Clock position method, bronshtein (right-hand rule) method, fetal heart, heart axis

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INTRODUCTION

Congenital heart defects (CHD) are the most common fetal anomaly, occurring in 8–9 per 1,000 live births (1). Fetal heart evaluation is an essential component of prenatal care, with the optimal timing for heart assessment occurring between 18 and 22 weeks of gestation (2).

Guidelines standardize the evaluation of fetal heart anatomy, emphasizing the importance of fetal heart axis assessment (2,3). During early development, the fetal heart axis is initially in the midline around 8 weeks of gestation and gradually rotates leftward by the end of the first trimester (4). In the second and third trimesters, the heart is positioned in the left thorax, with its long axis forming an angle of approximately 45° ± 20° to the anteroposterior thoracic axis (5). Deviations outside this range-whether leftward, midline, or rightward-are considered abnormal and may indicate congenital heart defects, diaphragmatic hernia, or thoracic mass lesions (6,7). When a four-chamber view of the heart is obtained, the fetal heart axis should be focused on, and the axis should be determined.

The Cordes method and the Bronshtein method are widely used techniques for determining fetal heart axis (8,9). Recently, Dursun et al. introduced the Clock position method, which provides a simpler approach for fetal heart axis evaluation (10). This method is particularly practical for obstetrics and gynecology clinicians due to its ease of use and independence from complex hand positioning.

We hypothesized that the Clock position method is faster and more accurate than the Bronshtein method, especially among first-year obstetrics and gynecology residents. The aim of this study was to compare the evaluation time and accuracy of the Clock position method and the Bronshtein method among first-year obstetrics and gynecology residents.

MATERIAL METHODS

This prospective study was conducted at Ankara Etlik City Hospital between February 2024 and June 2024 with ethical approval from the Institutional Ethical Committee (AESH-BADEK-2024-108). The study complied with the Helsinki Declaration of Ethical Principles.

Fetal Heart Axis Assessment Methods

Clock position method: This method involves the clinician sitting on the patient's right side, holding the ultrasound probe in the right hand, and using a transabdominal approach. The thoracic cavity is visualized as a clock, with the fetal spine always at 12 o'clock. In vertex presentation, the fetal heart is at 5 o'clock (Figure 1). In breech presentation, the fetal heart is at 7 o'clock (Figure 2). In transverse presentation, the probe is turned towards the mother's head and the axis is determined according to the fetal structure closest to the clinician (vertex or breech) (10).

Bronshtein method (right-hand rule): The clinician uses their right forearm and thumb as a model for fetal positioning. The dorsal forearm represents the fetal back, while the thumb always points toward the fetal left side, confirming heart orientation (9).

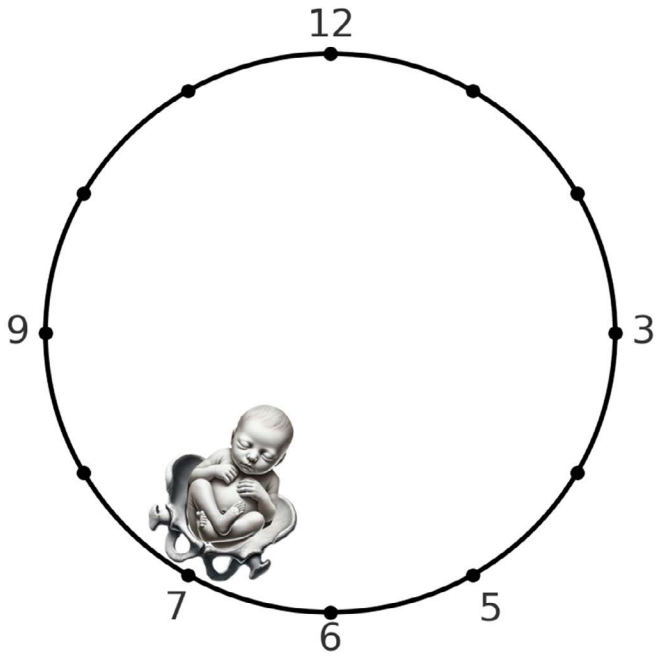

Figure 1. Illustration of the Clock position method for fetal heart axis evaluation in a fetus with vertex presentation. This image was generated using DALL·E, an artificial intelligence tool developed by OpenAI.

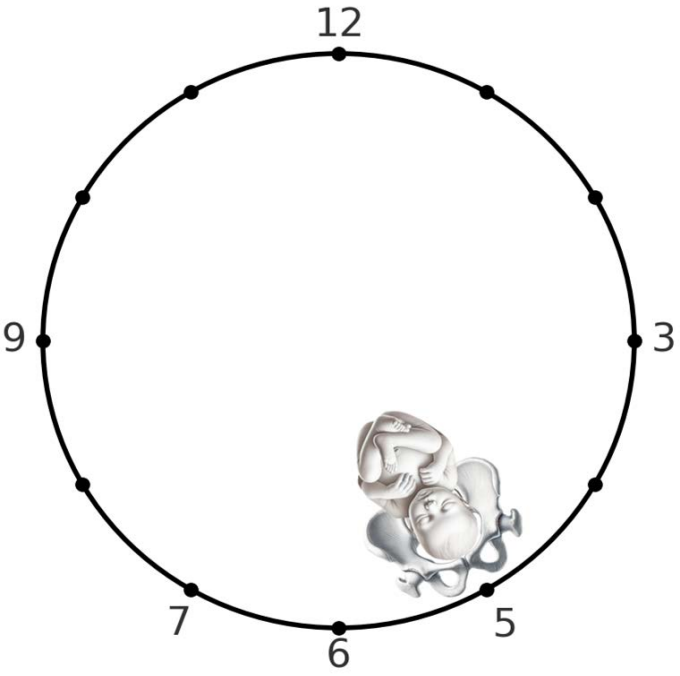

Figure 2. Illustration of the Clock position method for fetal heart axis evaluation in a fetus with breech presentation. This image was generated using DALL·E, an artificial intelligence tool developed by OpenAI.

Study Participants and Protocol

A total of 37 first-year obstetrics and gynecology residents and four pregnant women participated in this study. The residents were trained in both the Clock position method and the Bronshtein method by an experienced obstetrician (M.B.) before the study. Each resident evaluated the fetal heart axis of four different fetuses at 22 weeks of gestation without prior knowledge of the axis. All ultrasound examinations were performed transabdominally using a Voluson S10 ultrasound machine (GE Healthcare Ultrasound, Milwaukee, WI, USA). The four fetuses included three with normal heart axis representing vertex, breech, and transverse presentations and one fetus with vertex presentation and situs inversus totalis, with the heart axis positioned on the right side.(11) The residents were blinded to both the patients and the fetal axis. Each resident was brought into the ultrasound room one at a time and first assessed the fetal heart axis using the Clock position method, followed by the Bronshtein method. The time taken from the start of the evaluation to the final decision (in seconds) was recorded, and the accuracy of the fetal heart axis determination (true/false) was noted. The study included first-year obstetrics and gynecology residents who had no prior experience in fetal heart axis assessment and voluntarily participated. Residents with prior knowledge or experience in fetal heart axis evaluation were excluded. Pregnant women were informed about the study, and their participation was based on voluntary consent. Pregnant women who declined participation were excluded.

The primary outcome of this study was to measure the time required for each fetal heart axis assessment and the accuracy of fetal axis determination using both methods.

Statistical Analysis

All statistical analyses were performed using the SPSS software (version 29.0, IBM Corp., Armonk, NY, USA) to analyze the data. The Shapiro-Wilk test was performed to assess normality. Continuous variables were summarized as median and interquartile range (Q1-Q3), while categorical variables were presented as frequency and percentage. The Wilcoxon test was used to compare the time required for fetal heart axis evaluation between methods. Accuracy rates were analyzed descriptively. Since the Clock method demonstrated 100% accuracy across all cases, a statistical comparison of accuracy between methods was not feasible. A p-value of less than 0.05 was considered to show a statistically significant.

RESULTS

A total of 37 first-year obstetrics and gynecology residents were included in the study. The median age of the participants was 27 years (IQR: 26–29.5), and the median duration of residency training was 5 months (IQR: 4–6). The majority of the residents were female (n = 27, 73%), while male residents comprised 27% (n = 10) (Table 1).

Each resident evaluated four fetuses with the following presentations: vertex, breech, transverse, and vertex (situs inversus).The time required for fetal heart axis evaluation was significantly shorter with the Clock method compared to the

Table 1. Demographic Characteristics of First-Year Obstetrics and Gynecology Residents

		n=37
Age		27 (26-29.5)
Gender		
	Female	27 (73)
	Male	10 (27)
Duration of Residency Training (months)		5 (4-6)

Values are presented as median (Q1-Q3) and frequency (percentage).

Table 2. Comparison of Evaluation Time for Fetal Heart Axis Evaluation Between Methods

Fetal Position	**Clock Position Method (seconds)**	**Bronshtein Method (seconds)**	**p**
Vertex	17 (11 – 22)	28 (23 – 38)	<0.001
Breech	23 (18 – 38)	49 (40 – 55)	<0.001
Transverse	25 (23 – 34)	76 (40 – 90)	<0.001
Vertex (Situs inversus)	22 (15 – 27)	43 (30 – 48)	<0.001

Values are presented as median (Q1-Q3).

Table 3. Comparison of Accuracy Between Methods for Fetal Heart Axis Evaluation

Fetal Position	**Clock Position Method (Correct / Incorrect / Accuracy %)**	**Bronshtein Method (Correct / Incorrect / Accuracy %)**
Vertex	37 / 0 / 100%	35 / 2 / 94.6%
Breech	37 / 0 / 100%	33 / 4 / 89.2%
Transverse	37 / 0 / 100%	32 / 5 / 86.5%
Vertex (Situs inversus)	37 / 0 / 100%	30 / 7 / 81.1%

Bronshtein method across all fetal presentations ($p < 0.001$, for all comparisons). The Clock method had the shortest evaluation time in the vertex presentation (median: 17 seconds, IQR: 11–22) and the longest in the situs inversus presentation (median: 22 seconds, IQR: 15–27). In contrast, the Bronshtein method required longer evaluation times, with the shortest duration observed in the vertex position (median: 28 seconds, IQR: 23–38) and the longest in the transverse position (median: 76 seconds, IQR: 40–90) (Table 2).

The Clock method demonstrated 100% accuracy across all fetal positions. However, the Bronshtein method showed reduced accuracy, particularly in situs inversus cases (81.1%). Incorrect fetal heart axis assessments using the Bronshtein method were recorded in 2 vertex cases (accuracy: 94.6%), 4 breech cases (89.2%), 5 transverse cases (86.5%), and 7 situs inversus cases (81.1%) (Table 3).

DISCUSSION

This study evaluates the practicality and accuracy of the Clock position method in determining the fetal heart axis compared to the Bronshtein method. The findings demonstrate that the Clock position method is significantly faster and maintains a 100% accuracy rate across all fetal positions, making it a valuable technique for obstetrics and gynecology residents.

Lee et al. conducted a study on fetal ultrasound training among obstetrics and gynecology residents, concluding that only two-thirds of the participants believed they would achieve sufficient competency by the time of their graduation (12). This finding raises concerns about the adequacy of current ultrasound training programs in obstetrics and gynecology residency education.

Our findings align with those of Aktoz et al., who demonstrated that the Clock position method is faster and easier to learn compared to the Bronshtein and standard methods (13). Both studies highlight that the Clock position method eliminates the need for complex hand positioning, reducing cognitive load and making it more intuitive for inexperienced residents. While Aktoz et al. focused on general fetal heart axis evaluation, our study further supports its effectiveness across various fetal presentations, including situs inversus cases, where the Bronshtein method showed lower accuracy. These findings suggest that integrating the Clock position method into residency training could improve both efficiency and diagnostic precision in fetal heart assessment.

In clinical practice, obstetricians and gynecologists typically hold the ultrasound probe with their right hand during fetal assessment. The Bronshtein method also requires the use of the right hand to determine fetal situs (9). However, as the fetus moves or the heart assessment progresses, clinicians must repeatedly use their right hand for situs determination, which can lead to misinterpretation and confusion. Some clinicians attempt to mentally position themselves in place of the fetus to determine the heart axis and situs, further increasing cognitive load and the potential for errors. The Clock position method eliminates these challenges by offering a simplified and intuitive approach, making it easier to apply in clinical settings.

Liu et al. investigated the assessment of fetal heart axis in congenital heart disease using fetal heart magnetic resonance imaging (MRI) and reported a strong correlation between ultrasound and MRI findings (14). Their study highlights the importance of ultrasound in fetal heart assessment. Accurate determination of the heart axis is crucial for identifying potential congenital heart abnormalities. The Clock position method, particularly for novice obstetrics and gynecology residents, reduces the risk of errors and facilitates a more structured approach to fetal heart evaluation.

One of the strengths of this study is the direct comparison between the Clock position method and the Bronshtein method for fetal heart axis determination, contributing further evidence on the effectiveness and accuracy of these techniques. The inclusion of various fetal presentations, including situs inversus cases, enhances the study's clinical relevance. Additionally, by evaluating both time effectiveness and accuracy, this study provides a comprehensive assessment of these methods. However, this study has certain limitations. As a single-center study, its external validity and generalizability are limited. Furthermore, the sample size (37 participants, 4 fetal positions) may not be sufficient to draw broader conclusions. Future studies with larger, multi-center cohorts should validate these findings and further investigate the method's long-term benefits in clinical training and practice.

CONCLUSION

The Clock method provides a faster and more accurate approach for fetal heart axis determination than the Bronshtein method across all fetal positions. Its simple application, independence from fetal movements, and reduced cognitive load make it a valuable technique for obstetrics and gynecology residents, particularly those in the early stages of training.

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