

# The prenatal use of KANET scoring in fetal isolated mild ventriculomegaly: A single center study

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## ABSTRACT

Kurjak Antenatal Neurodevelopmental Test (KANET) was developed for the assessment of fetal neurobehavior and the detection of neurological disorders. We aimed to evaluate the prenatal use of KANET scoring in fetuses with isolated ventriculomegaly in the third trimester of pregnancy.

The present study was planned as a prospective and cohort trial. A total of 75 pregnant women; 41 healthy controls and 34 pregnancies with isolated mild ventriculomegaly fetuses were included in the study. All pregnant women were assessed with KANET scoring by 4 dimension ultrasound in the third trimester of pregnancy. The obstetric outcomes of the pregnant women were also recorded.

The study and control groups exhibited no significant difference with respect to maternal age, body mass index, delivery week and other obstetric outcomes. The KANET scores of the fetuses ( $16\pm 2$  versus  $15\pm 2$ ,  $p: 0.241$ ) were similar between the study and control groups.

Prenatally diagnosed isolated mild ventriculomegaly has not any effect on fetal neurobehavior which was assessed by KANET scoring in the third trimester gestation. The frequent and widespread use of 4 dimension ultrasound in obstetric routine practice would improve the early diagnosis of fetal neurological disorders.

**Keywords:** Kurjak Antenatal Neurodevelopmental Test, Isolated mild ventriculomegaly, Fetus, 4 dimension ultrasound

## Introduction

Ventriculomegaly (VM) is one of the most frequently diagnosed fetal abnormalities of the central nervous system (CNS) (1) with an incidence of 0,3-2 per 1000 pregnancies (2). VM is defined as the enlargement of the atrial lateral ventricles (LV) of more than 10mm at 15-40 gestational weeks (3). It is classified into three groups regarding ventricular diameter: Mild VM (10-12mm), moderate VM (12-15mm) and severe VM (>15mm) (4). The prognosis of moderate and severe VM, isolated or associated with other abnormalities, is sufficiently known. In contrast, there is still missing data about the prognosis of mild VM. Therefore, it is more difficult to counsel parents of fetuses with mild VM which was our most important encouragement for the study. In this point, we have to take in the aspect that the fetal behavior is a reliable parameter giving an idea about the neurological development (5-8). So, in the current trial we criticize the prenatal fetal behavior of fetuses with isolated mild VM compared with fetuses without VM by using Kurjak Antenatal Neurodevelopmental Test (KANET) by using 4-dimension (4D) ultrasound.

## Materials and Methods

The current research was a prospective cohort trial which was designed in Balıkesir University Medical Faculty Department of Obstetrics and Gynecology between January 2020 and January 2023. The research protocol was approved by the Local Ethics Committee of Balıkesir University and all participants gave informed consent. The study was designed in accordance with the declaration of Helsinki. MedCalc statistical software (version 10.3.0.0) was used for calculation of sample size. Sample size was calculated with an alpha of 0.05, a power of 80, and medium effect size ( $f$ ) 0.25. 96 singleton pregnant women between 32<sup>nd</sup> and 36<sup>th</sup> gestational week enrolled in the study. Gestational age was estimated by the first trimester fetal screening. Excluding criteria were: multigravidae, disorders during pregnancy like gestational hypertension, preeclampsia or gestational diabetes mellitus, >40 Body Mass Index (BMI), neurological and muscle disorders. The control group included 55 healthy pregnancies between 32<sup>nd</sup> and 36<sup>th</sup> gestational week. The study was included 42 pregnancies which were complicated by mild VM in

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their fetuses. Fetal ultrasound examination was performed for both groups. All ultrasound examinations were made by the same associate professor in our perinatology clinic. VM was defined as the atrial width of LV above 10 mm. First, the fetal head's axial view was obtained. Then, the LVs were measured vertically on the trans-ventricular plane (at the level of the glomus of the choroid plexus). We took attention to positioning the calipers inside the echo generated by the LV. VM was categorized: mild VM (atrial diameter 10-12 mm), moderate VM (atrial diameter 12-15 mm) and severe VM (atrial diameter > 15 mm). Moderate and severe VM patients were excluded from the study. After final detailed ultrasound examination, mild VM patients without any additional structural abnormalities, associated malformations and aneuploidy were included to the study group. KANET scoring was made by GE Voluson E 6 4D US probe. All assessments were done when the fetus was awake. The maximum examination time was 30 minutes. KANET score classification: Normal KANET score (14-20 points), borderline KANET score (6-13 points) and abnormal KANET score (above 5 points). KANET consisted of isolated head movements (0-2 points), isolated hand movements (0-2 points), isolated leg movements (0-2 points), cranial sutures (0-2 points), hand to face/head movements (0-2 points), finger movements (0-2 points, yawning – mouthing (0-2 points), facial expressions (0-2 points), isolated eye blinking (0-2 points), "Gestalt" perception (0-2 points). 13 cases from the healthy control group and 8 cases from the isolated mild VM group were excluded from the study due to suboptimal screening during 4D ultrasound. The obstetric outcomes of the patients like gravida, parity, delivery week, birthweight, Apgar scores and NICU admission were also recorded.

Descriptive values were demonstrated as mean and standard deviation. The continuous and categorical variables were analyzed with Student's *t*-test and Chi-Square test, respectively. Statistical significance levels were considered as 5%. The data was analyzed by SPSS (IBM SPSS Statistics for Windows, Version 22.0. IBM Corp. Released 2013. Armonk, NY: IBM Corp.)

## Results

A total of 75 pregnant women; 41 healthy controls (Group 1) and 34 pregnant women complicated with isolated mild VM fetuses (Group 2) were included in the study population. The clinical characteristics, obstetric outcomes and KANET scores were demonstrated in Table 1. Group 1 and group 2

exhibited no significant difference with respect to maternal age, BMI, delivery week, birth weight and Apgar scores (Table 1). The KANET scores ( $16 \pm 2$  versus  $15 \pm 2$ ,  $p: .241$ ) were higher in group 1 than in group 2. However, there was no significant difference between the groups in KANET scores. The gestational age at KANET scoring and NICU admission rates were similar between the groups ( $p: .473$  and  $p: .850$  respectively) (Table 1).

## Discussion

The current study compared the neurological development of fetuses with isolated mild VM and healthy controls without any VM by using KANET scoring system with 4D ultrasound. We did not find any significant difference between healthy and VM cases. Prenatally diagnosed isolated mild VM has not any effect on fetal behavior in the third trimester of pregnancy.

In general, obstetricians believe that the fetal behavior reflects the fetal neurological development. Most trials focused on the postnatal outcomes of these fetuses (9). Fetal magnetic resonance imaging (MRI) is the most helpful tool for screening fetal CNS in the literature (10). Despite developing technology on fetal imaging, there is a lack of information about prenatal screening of the fetal neurological development. It is a fact that the functional evaluation of the fetal CNS is still poorly established in utero. There are many studies in the literature trying to make a relation between the degree of VM and the fetal neurological development (11). However, it is difficult to predict the postnatal outcome of isolated mild VM fetuses.

The KANET scoring system is a useful method for obstetricians to distinguish abnormal from normal fetal behavior (12). Many studies, which assessed fetal behavior in utero, have focused on four areas: motor activity, fetal heart rate, responsiveness to extra-uterine stimuli and behavioral activity (13-15). The KANET scoring system evaluates quantitative and qualitative views of fetal motor behavioral models. This technique gives a better opportunity to observe fetal movements (16).

The current study demonstrates that isolated VM and gestational age matched healthy fetuses have similar KANET scores in the third trimester of gestation. Talic et al. assessed the fetal behavior patterns of fetuses with normal brain morphology and different degrees of VM by using KANET scoring. Confirming with our outcomes, they did not find any abnormal KANET score in the isolated mild VM cases, too. Even more, they also found an obvious difference between the KANET scores of the fetuses with severe isolated VM and mild isolated VM (16).

**Table 1:** The Clinical Characteristics, Obstetric Outcomes and KANET Scores of The Patients

Table 1	Group 1 (control) (n:41)	Group 2 (mild ventriculomegaly) (n:34)	p value
Maternal age (years)	29.2 ± 4.6	31.2 ± 6.5	0.134a
BMI (kg/m <sup>2</sup> )	28.8 ± 4.8	28.3 ± 5.1	0.634 a
Gravida	3±1	3±1	0.794 a
Parity	1±1	2±2	0.335 a
Gestational age at delivery (weeks)	38.6 ± 1.1	38.2 ±1.0	0.086 a
Birthweight (g)	3419 ± 365	3294 ± 457	0.201 a
Apgar, 1. minute	7 ± 1	7 ± 1	0.104 a
Apgar, 5. minutes	8 ± 1	9 ± 1	0.091 a
NICU admission	3	2	0.850 b
Gestational age at testing (weeks)	34.1±1.2	34.3±1.1	0.473 a
KANET score	16 ± 2	15 ± 2	0.241 a

<sup>a</sup> Student's t-test was used to compare continuous variables

<sup>b</sup> Chi- square test was used to compare categorical variables

BMI: Body mass index; LV: Laterale ventricular; NICU: Neonatale intensive care unit;

Additionally, serious functional impairments due to structural abnormalities can be identified by KANET in other studies (17-22). Besides, the fetal behavior in the prenatal period shows constancy with the behavior in the postnatal period (23-25). Furthermore, Andonotopo et al. outline that growth restricted fetuses show a less behavioral activity in the third trimester of pregnancy (26).

Our study has some limitations. First, the present study is just an observational cohort trial. It was not designed as a long term follow up trial. So, we did not take regard on the patients' postnatal outcomes. Second, our sample size is relatively small. Third, we only focused on isolated mild VM fetuses. We did not include fetuses with moderate and severe VM.

In the present study we concluded that prenatally diagnosed isolated mild VM has not any effect on fetal behavior in utero. Our findings lead us to the idea whether the normal fetal behavior score by KANET in isolated VM fetuses have better postnatal outcomes regarding neurological development. We suggest that if a high KANET score in an isolated VM is found, obstetricians can predict more favorable postnatal outcomes. Indeed, this gives the opportunity of an optimal obstetric counsel with better prognostic conclusions for parents of isolated mild VM fetuses. Apart from this, the role of the 4D ultrasound in the third trimester screening should not be underestimated. Parents mostly require the 4-dimensional ultrasound screening as an opportunity for a view of the fetuses' face. The KANET scoring system is carried out with the 4D ultrasound. Thus,

this can increase and even improve the clinical use of 4D ultrasound in routine obstetric practice. However, in utero fetal assessments should be integrated with postnatal neurodevelopmental assessments. Larger and prognostic follow-up studies about this subject are needed to contribute to the literature.

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