Van Med J 31 (2): 133-141, 2024
DOI: 10.5505/vmj.2024.77487

Evaluation of Fetal Central Nervous System Anomalies Diagnosed Prenatally: Prenatal and Postnatal Outcomes

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Abstract

Introduction: The aim of this study is to examine the diagnosis types and rates of patients with central nervous system (CNS) anomalies detected in the prenatal period between 2021-2022 in our perinatology clinic and to contribute to the literature.

Materials and Methods: Our study included 191 patients with CNS anomaly and whose pregnancy results were reached. Demographic characteristics of the patients, additional detected anomalies, fetal Magnetic Resonance Imaging (MRI) and genetic results, obstetric and neonatal results were evaluated if requested.

Results: Neural tube defects (NTD) were found most frequently at 75.3%, and among these, acrania was found most frequently at 27.2%. While 74.3% of the detected CNS anomalies were isolated anomalies, it was found that 5.2% were accompanied by additional CNS anomalies and 21.9% were accompanied by additional extracranial anomalies. Abnormal karyotype was obtained in 12.1% of the patients who wanted to have a prenatal diagnosis test. It was found that 11% of the patients requested fetal MRI and ventriculomegaly was the most common fetal MRI indication. While the pregnancies of 56.5% of the patients were terminated, 37.7% of them gave live births. The rate of surgical intervention in live-born babies with CNS anomalies was found to be 56.9%. A total mortality rate of 43% was found in live-born babies.

Conclusion: Since CNS anomalies are associated with serious morbidity and mortality; Prenatal diagnosis is very important so that families can be offered a pregnancy termination option and those who will continue to be pregnant should be informed about the treatment and rehabilitation processes of their babies.

Key words: Central nervous system; fetal anomalies; prenatal diagnosis; ultrasonography

Introduction

Fetal structural anomalies are seen in approximately 2% of all pregnancies (1). Central nervous system (CNS) anomalies, which constitute approximately 1/3 of fetal structural anomalies detected in the perinatal period, are the second most common group after cardiac anomalies (2,3). It has been reported that the incidence of CNS anomalies is 1-2/1000 in live births (4). NTD (Neural Tube Defect) (acrania, anencephaly, spina bifida, encephalocele), ventral induction errors (holoprosencephaly), ventriculomegaly, posterior fossa anomalies (Dandy–Walker complex, inferior vermian agenesis, mega cisterna magna), vascular malformations, corpus callosum (CC) agenesis constitutes CNS anomalies (5). Ultrasonography (US) is the primary and most frequently used diagnostic tool for detecting CNS anomalies (6). Major processes such as neuronal proliferation, migration or organization in the CNS developmental process occur in the second half of pregnancy. However, most of the CNS anomalies can be detected with a detailed US evaluation performed during the 18-20 weeks of pregnancy. (7). Fetal Magnetic Resonance Imaging (MRI),

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Received: 21.03.2024, Accepted: 27.11.2023

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which is another diagnostic tool, can be used to confirm the CNS anomaly detected by US, to detect additional CNS anomalies, if any, and in cases where US examination cannot be performed optimally (6). CNS anomalies can occur in isolation or as a part of a systemic syndrome. Chromosomal anomalies can be detected in cases with CNS anomalies (2). There is a risk of detecting a chromosomal anomaly in 9.5% (8) cases in anencephaly, 10.3% in spina bifida (9), 5-7% in ventriculomegaly (10), 11.1% in encephalocele (11) and 25-50% (12) in holoprosencephaly. Detailed US and systematic fetal evaluation and fetal karyotype analysis are required in order to reveal the prognosis and management of cases with CNS anomalies. Since CNS anomalies carry a very high risk of morbidity and mortality, it has become very important to identify these anomalies in the early stages of pregnancy and to intervene if necessary. It is necessary to determine the fetal prognosis, to give the necessary counselling to the family, and to offer the option of terminating the pregnancy in severe anomalies. In this study, we aimed to examine the diagnosis types and rates, genetic results, and obstetric and neonatal outcomes of patients with CNS anomalies detected in the prenatal period between 2021-2022 in our perinatology clinic, and to contribute to the literature.

Materials and Methods

The data of 7680 patients who applied to Van Yüzüncü Yıl University Perinatology Department between January 1, 2021, and December 31, 2022, were scanned. CNS anomaly was detected in 247 of the patients. Since 53 of the patients did not give birth yet or pregnancy results could not be reached, and some cranial findings due to intrauterine infections may be seen in three of them, infection was suspected in the blood parameters, and they were not included in the study. A total of 191 patients were still included in the study. All patients were evaluated in terms of the prognosis of the anomaly detected in the perinatology council and its compatibility with life, and then detailed information was given to the families on these issues. Data were obtained retrospectively from the digital hospital data system and the perinatology polyclinic notebook. Demographic characteristics of the patients, CNS anomaly and gestational week, additional detected anomalies, fetal MRI and genetic results if requested, perinatology council results, obstetric and neonatal results (whether the baby is alive or not, surgical intervention status, time of death if dead)) were evaluated. In order to obtain neonatal results, the digital hospital data system was scanned for the status of the children of those whose pregnancy was not terminated and who gave birth in our hospital. Afterwards, all patients whose pregnancies were not terminated were contacted by phone and information about their babies was obtained. Chorionic villus sampling,amniocentesis or cordocentesis options were offered to all patients for prenatal diagnosis. Oral information was given to the patients and their spouses about how the procedures were performed, possible complications and the benefits of the genetic result to be obtained after the procedure. Written consent was obtained from the couples who agreed to undergo the procedure before starting the procedure, and then the procedures were performed.

Ethical approval: In our study, written consent was obtained from all the cases participating in our study, in accordance with the Declaration of Helsinki. Ethics Committee permission was obtained from Van Yüzüncü Yıl University Medical Faculty Clinical Research Ethics Committee with the decision dated 14.04.2023 and numbered 2023/04-15.

Statistical analysis: While evaluating the findings obtained in the study, SPSS 22 for Windows (Statistical Package for Social Sciences, IBM SPSS Inc.) program was used for statistical analysis. Total count, mean, standard deviation, minimum maximum values, number and percentage values are given as descriptive statistics.

Results

In our study, the data of 7680 patients who applied to the perinatology outpatient clinic were scanned. 247 (3.2%) patients with CNS anomalies were identified. 53 patients who did not give birth or whose pregnancy results could not be reached and 3 patients with suspected intrauterine infection were excluded from the study. The mean age of 191 patients included in the study was 28.12±6.51 (18-49), mean week of gestation was 20.4±5.75 (12-38), mean gravida was 2.85±1.87 (1-8) The mean parity was 1.47±1.56 (0-7), the mean of abortion was 0.39±0.82 (0-4), and the mean number of living children was 1.41±1.51 (0-7). Fetal CNS anomaly was detected in the first trimester in 18.3% of the patients, in the second trimester in 72.3% and in the third trimester in 9.4%. The mean gestational week in which CNS anomaly was detected in the patients was found to be 20.4. The clinical features of the patients are shown in Table 1.

Table 1: Clinical Characteristics of the Patients

	Mean	Standard deviation	Minimum	Maximum
Age	28.12	6.51	18	49
Gestational week	20.4	5.75	12	38
Gravida	2.85	1.87	1	8
Parity	1.47	1.56	0	7
Abortion	0.39	0.82	0	4
Living child	1.41	1.51	0	7

Tablo 2: Distribution of CNS Anomalies

	Isolated anomaly		Additional CNS anomaly		Extracranial anomaly		Total	
	n	%	n	%	n	%	n	%
Acrania	44	84.7	1	1.9	7	13.4	52	27.2
Anencephaly	17	63.0	0	0	10	37.0	27	14.1
Encephalocele	13	81.2	0	0	3	18.8	16	8.4
Meningocele	2	100.0	0	0	0	0	2	1.0
Spina bifida	43	91.5	0	0	4	8.5	47	24.6
CC agenesis	0	0	2	100.0	1	50.0	2	1.0
Holoprosencephaly	1	25.0	0	0	3	75.0	4	2.1
Ventriclomegaly								
Mild	4	100.0	0	0	0	0	4	2.1
Modarate	4	80.0	0	0	1	20.0	5	2.6
Severe	10	58.8	0	0	7	41.2	17	8.9
Hydranencephaly	0	0	0	0	2	100.0	2	1.0
Iniencephaly	1	50.0	0	0	1	50.0	2	1.0
Mega cisterna magna	0	0	1	100.0	0	0	1	0.5
Blake pouch cyst	0	0	1	100.0	0	0	1	0.5
Arachnoid cyst	1	100.0	0	0	0	0	1	0.5
Cerebellar hypoplasia	0	0	2	100.0	0	0	2	1.0
Vermian hypoplasia	0	0	1	100.0	0	0	1	0.5
Pontocerebellar hypoplasia	1	33.3	2	66.7	2	66.7	3	0.6
Dandy-Walker Malformation	1	50.0	0	0	1	50.0	2	1.0
Total	142	74.3	10	5.2	42	21.9	191	100

CC: Corpus callosum, **CNS:** Central nervous system

In order of frequency, 27.2% of the patients had acrania, 24.6% had spina bifida, and 14.1% had anencephaly. If evaluated as a group, 75.3% of the patients had NTD and 13.6% had ventriculomegaly. It was found that ventriculomegaly was mild in 15.4%, moderate in 19.2%, and severe in 65.4%. While 74.3% of the detected CNS anomalies were isolated anomalies, 5.2% were accompanied by additional CNS anomalies and 21.9% were accompanied by additional extracranial anomalies. An additional CNS anomaly and an extracranial anomaly were found to accompany the CNS anomaly in three patients. Additional CNS anomalies were found most frequently in posterior fossa anomalies and CC agenesis. Extracranial anomalies were found to be accompanied by 100% in hydranencephaly, 75% in holoprosencephaly, and 66.7% in pontocerebellar hypoplasia. The distribution of CNS anomalies is shown in Table 2. It was found that extremity anomalies constituted the most common extracranial anomaly group accompanying CNS anomalies with a rate of 31.4%. This was followed by cardiac anomalies at 13.7%, facial anomalies at 11.8% and anterior abdominal wall defects. A prenatal diagnostic test option was offered to all patients with CNS anomalies. Thirty-three (17.3%) patients wanted to have a procedure for prenatal diagnosis. Amniocentesis was performed in 28 patients, chorionic villus sampling in four patients, and cordocentesis in one patient. Abnormal karyotype was detected in four of the patients who were operated for prenatal diagnosis. Of the karyotypes detected as abnormal, one was found to be numerical and three were structural anomalies.

Pregnancies were terminated upon the request of all patients with abnormal karyotype, their spouses and themselves. The prenatal diagnostic test results of the patients with CNS anomaly and the pregnancy results of those with abnormal karyotypes are shown in Table 3. In addition to US, fetal MRI was requested in 11% of the patients to confirm the diagnosis or to detect additional anomalies. Patients with ventriculomegaly constituted 42.8% of the patients for whom fetal MRI was requested, and it was found that this was the most common indication for fetal MRI. When fetal MRI results are examined; It was seen that no new anomaly was detected in addition to the anomalies detected by US in any patient with fetal MRI, and fetal MRI

Table 3: Prenatal Diagnostic Test Results of Patients with CNS Anomaly and Pregnancy Results of Patients with Abnormal Karyotype

	Normal	**Abnormal**	**None**
Karyotype	29	4	158
Abnormal result	Indication	Additional anomaly	Pregnancy outcome
Trisomy 18	Spina bifida	Diaphragmatic hernia	Termination
46,X ,der(7)add(7)(q22)	Severe ventriculomegaly	None	Termination
46,X*,inv(9)(p11q13)	Spina bifida	Club foot	Termination
46,X,der(1)add(1)(p36.3)[3]/46,X[90]	Holoprosencephaly	Club foot	Termination

add: Addition, **CNS:** Central nervous system, **der:** Derivative, **inv:** Inversion

Table 4: Distribution of Patients Requested Fetal MRI by US Diagnosis

	n	**%**
Encephalocele	1	4.8
Spina bifida	1	4.8
CC agenesis	1	4.8
Holoprosencephaly	1	4.8
Ventriculomegaly Mild	2	9.5
Moderate	2	9.5
Severe	5	23.8
Mega cisterna magna	1	4.8
Arachnoid cyst	1	4.8
Cerebellar hypoplasia	2	9.5
Vermian hypoplasia	1	4.8
Pontocerebellar hypoplasia	2	9.5
Dandy-walker malformation	1	4.8
Total	21	100

CC: Corpus callosum, **CNS:** Central nervous system, **MRI**: Magnetic Resonance Imaging, **US:** Ultrasonogr

results of all patients were consistent with perinatal US results. The distribution of patients who requested fetal MRI according to the diagnoses determined by US is shown in Table 4. While the pregnancies of 56.5% of the patients with CNS anomalies were terminated, 37.7% had live births. Intrauterine fetal death was detected in 5.8% of the patients. The number of patients who gave live birth outside our clinic was 26, and the number of patients with intrauterine fetal death was five. In our study, it was found that 80.8% of acrania cases, which are the most frequently detected CNS anomalies, 44.7% of spina bifida cases and 70.4% of anencephaly cases were terminated. Six of a total of 11 intrauterine fetal deaths were found in patients with acrania. Of the total 72 live births, 26 (36.1%) were patients with spina bifida and 18 (25%) with ventriculomegaly.

Table 5: Pregnancy Results of Patients with CNS Anomaly

	Termination		Intrauterine fetal death		Live birth		Total	Live Births				
								Operation		<3 months of death	>3 months of death	Live
	n	%	n	%	n	%	n	Yes	No	n	n	n
Acrania	42	80.8	6	11.5	4	7.7	52	0	4	4	0	0
Anencephaly	19	70.4	2	7.4	6	22.2	27	0	6	6	0	0
Encephalocele	9	56.2	1	6.3	6	37.5	16	5	1	3	0	3
Meningocele	0	0	0	0	2	100	2	2	0	0	0	2
Spina bifida	21	44.7	0	0	26	55.3	47	25	1	5	3	18
CC agenesis	0	0	1	50.0	1	50.0	2	0	1	0	0	1
Holoprosencephaly	3	75.0	0	0	1	25.0	4	0	1	1	0	0
Ventriculomegaly												
Mild	0	0	0	0	4	100	4	0	4	0	0	4
Moderate	0	0	1	25.0	4	75.0	5	1	3	0	0	4
Severe	7	41.2	0	0	10	58.8	17	6	4	2	2	6
Hydranencephaly	1	50.0	0	0	1	50.0	2	1	0	1	0	0
İniencephaly	2	100	0	0	0	0	2	0	0	0	0	0
Mega cisterna magna	0	0	0	0	1	100	1	0	1	0	0	1
Blake pouch cyst	0	0	0	0	1	100	1	0	1	0	0	1
Arachnoid cyst	0	0	0	0	1	100	1	1	0	0	0	1
Cerebellar hypoplasia	2	100	0	0	0	0	2	0	0	0	0	0
Vermian hypoplasia	0	0	0	0	1	100	1	0	1	0	1	0
Pontocerebellar hypoplasia	2	66.7	0	0	1	33.3	3	0	1	0	1	0
Dandy-walker malformation	0	0	0	0	2	100	2	0	2	2	0	0
Total	108	56.5	11	5.8	72	37.7	191	41	31	24	7	41

CC: Corpus callosum, **CNS:** Central nervous system

The rate of surgical intervention in live-born babies with CNS anomalies was found to be 56.9%. It was determined that 25 of 26 live-born babies diagnosed with spina bifida and 6 of 10 babies diagnosed with severe ventriculomegaly were operated on. A total mortality rate of 43% was found in live-born babies, 33.3% in the first three months after birth and 9.7% in the first three months. In our study, in which the baby with the longest follow-up was 20 months old, 56.9% of live-born babies were found to be alive. Babies with spina bifida constituted 43.9% of the survivors. The pregnancy results of patients with CNS anomalies are shown in Table 5.

Discussion

Detection of fetal CNS anomalies in the early perinatal period, which constitutes the second most common group after cardiac anomalies and constitutes approximately 1/3 of structural fetal anomalies, is extremely important in terms of determining prognosis and pregnancy management (2,3). In our study, patients were diagnosed most frequently in the second trimester and at an average of 20.4 weeks of gestation. Similar to our study, in a study in which 101 CNS anomalies were evaluated, patients were diagnosed most frequently in the second trimester and at an average of 20.6 gestational weeks (13). In another study, the mean diagnosis week was found to be 21.9 (14). It was thought that the fact that fetal anomaly screening was performed at 18-22 weeks of gestation in our clinic, as in many centres, led to the conclusion that CNS anomalies were mostly detected in this period. In our study, the most common CNS anomalies were found as acrania, spina bifida and anencephaly, respectively. When considered as a group, it was found that NTD was the most common. Ventriculomegaly constituted the second most common group. There are studies in the literature that reach different results regarding the incidence of CNS anomaly type. In a study evaluating 118 CNS anomalies in the Netherlands, NTD was found in 51% of the patients and ventriculomegaly/hydrocephalus was found in 26% (2). Domröse et al. found hydrocephalus to be the most common CNS anomaly (15). In another study, NTD was found to be the most common CNS anomaly (16). In a study evaluating 712 CNS anomalies in Turkey, the most common CNS anomaly was found to be ventriculomegaly (14). Although the aetiology of NTD is based on many different environmental and genetic causes, folate deficiency in the mother has an important place in the aetiology, and the incidence of NTD decreases with the use of folic acid in the preconceptional period (17). It was thought that most of the women did not use folic acid in the preconceptional period due to the socioeconomic structure of the region where our clinic is located, and this situation contributed to NTD being the most common CNS anomaly in our study. CNS anomalies can often be accompanied by extracranial anomalies. In our study, it was found that 5.2% of the CNS anomalies were accompanied by an additional CNS anomaly and 21.9% were accompanied by an additional extracranial anomaly. The most common extremity and cardiac anomalies were found to be associated with CNS anomalies. Adama et al. found the rate of isolated CNS anomaly to be 53.4% and the rate of CNS anomaly with extracranial anomaly to be 32.2% (2). Gumus et al. in their study, isolated CNS anomaly was found to be 26.7%, CNS anomaly with extracranial anomaly was 51.5%, and it was stated that extremity anomalies were the most common accompanying extracranial anomaly group (13). In a study in which 725 patients with CNS anomalies were evaluated, extracranial anomalies were found in 26% of the patients, and it was stated that the most common of these were multiple anomalies (18). Acrania cases constitute a large part of the anomalies in our study, such as 27.2%. In our study, the mean gestational week in which acrania cases were detected was found to be 15. It was thought that termination of pregnancies in this group before reaching the weeks in which fetal anomaly screening would be performed after being detected in the early weeks of pregnancy caused a lower rate of extracranial anomaly to be detected in our study than in the literature. In our study, all patients with CNS anomalies were offered a prenatal diagnostic test option for the detection of chromosomal anomalies. 15.2% of the patients wanted to have diagnostic tests and the chromosomal anomaly was detected in 13.8% of the patients who had the test. Gumus et al. karyotype anomaly was detected in 11.9% of the patients in whom CNS anomaly was detected in the study conducted by him (13). In another study in which 618 patients with CNS anomalies were evaluated, karyotype analysis was requested from 22.8% of the patients and the chromosomal anomaly was detected in 19.7% of them (18). In a study in which other 365 patients were evaluated, prenatal diagnosis was applied to 30.4% of the patients and karyotype anomaly was found in 49.1% of the patients who underwent the procedure. In the same study, the extracranial anomaly was detected in 54.2% of the patients (19). In our study, the extracranial anomaly was detected in 21.9% of the patients. In this study, it

was thought that extracranial anomalies, which were higher than our study, caused the karyotype anomalies to be found higher than our study. It was thought that karyotype analysis evaluations by increasing the number of patients and grouping the patients with CNS anomaly as those with isolated anomaly and those with extracranial anomaly would yield more reliable results. Fetal MRI is an option for further evaluation in case of diagnostic uncertainty after US evaluation in the detection of CNS anomalies (20). Fetal MRI was requested from 11% of the patients in our study. Patients with ventriculomegaly constituted the group most frequently requested fetal MRI. In fetal MRI results, no new anomaly was detected in addition to the anomalies detected by ultrasonography in any of the patients. Perinatal US results and fetal MR results were found to be compatible with all patients who requested fetal MRI. In a study with similar results to our study, fetal MRI was requested from 14.9% of the patients and ventriculomegaly was the most common indication for fetal MRI. In the same study, 90.2% of fetal MRI results were found to be compatible with prenatal US results (18). Malinger et al. found in their study that fetal MRI and US had equal value in the prenatal diagnosis of CNS anomalies (21). In another study in which 183 patients with CNS anomaly were evaluated, fetal MRI was requested from only 13 patients (7.1%), and it was found that US results and fetal MRI results were compatible in all 13 patients (22). These results show that US is the first diagnostic method to be used in the detection of CNS anomalies. In the evaluation of CNS anomalies, fetal MRI is a relatively new diagnostic tool in our centre, as in many centres, and is not used as widely as US. Since morbidity and mortality are high in fetuses with severe CNS anomaly, pregnancy termination can be applied in accordance with current laws, by consulting families and obtaining their consent. In our study, 56.5% of the patients terminated their pregnancies, and intrauterine fetal death was detected in 5.8% of them. The termination rate was 80.8% in acrania and 70.4% in anencephaly, which are anomalies incompatible with life. In a study, it was found that 53.2% of 618 patients resulted in live birth, 42.7% with termination, and 4% with intra-uterine fetal death. In the same study, a termination rate of 91.5% was found in acrania/anencephaly cases (18). In another study, the pregnancies of 68.3% of the patients with CNS anomalies were terminated (13). In a study in which 279 patients with CNS anomaly were evaluated, the pregnancy termination rate was found to be 47.3% (19), and in another study in which 118 patients were evaluated, it was found to be 45.8% (2). Socio-cultural status and religious beliefs have important effects on families' decision to terminate pregnancy. The effect of this situation is great in the different pregnancy termination rates in studies.In our study, 37.7% of the patients gave live birth. 36.1% of the patients who gave live birth were patients with spina bifida and 25% with ventriculomegaly. It was found that there was a 43% mortality rate in the follow-up of live-born babies. In a study, the live birth rate was found to be 59% in patients with CNS anomalies (22). In a study with similar results to our study, the live birth rate was found to be 39.0%, and the mortality rate of infants in the postnatal follow-up was found to be 37% (2). In another study in which 279 cases were evaluated, the live birth rate was found to be 49.8%. In the same study, 15.1% of babies could not be followed up, and a mortality rate of 30.9% was found in those who were followed up (19). A lateral ventricle diameter of 10-12 mm is defined as mild, 12-15 mm as moderate, and greater than 15 mm as severe ventriculomegaly (23). In our study, 60% of babies with severe ventriculomegaly were operated after delivery. While infant death is not observed in mild and moderate ventriculomegaly; a 40% mortality rate was found in severe ventriculomegaly. In a study, it was found that 10% of 155 babies who were found to have ventriculomegaly in the prenatal period were operated on after birth, and all the patients who were operated on were babies with severe ventriculomegaly. In the same study, a 12% infant mortality rate was found in patients with severe ventriculomegaly. Similar to our study, infant mortality was not observed in mild and moderate ventriculomegaly (18). Karsidag et al. found that no problem developed in the postnatal period in isolated mild and moderate ventriculomegaly (24). The degree of ventriculomegaly is one of the most important criteria determining the prognosis. In our study, it was found that as the degree of ventriculomegaly increased, the need for surgery and the infant mortality rate increased in line with the literature. In our study, 96.1% of babies with spina bifida were operated after delivery. A mortality rate of 44.4% was found in the follow-up of babies with spina bifida. Similar to our study, in a study in which 76 infants with spina bifida were evaluated, the operation rate was found to be 98.7%. In the same study, the infant mortality rate was found as 13.6% (18). Bowman et al. in his study, the operation rate was found to be 86% and the infant mortality rate at follow-up was found to be 24% (25). In another study, the mortality rate of babies with spina bifida in the

first 3 months was found to be 33.3% (2). Although early neonatal surgery in spina bifida cases is associated with higher survival, it cannot prevent or reduce other damages such as paralysis (26). In our study, although a high rate of surgery was performed on infants with spina bifida in the early neonatal period, a higher infant mortality rate was found than in other studies in the literature. Follow-up and home care of babies who have undergone surgery are very important. It was thought that the low socioeconomic status of the region where our study was conducted affected the care and follow-up of babies who were operated on and caused high infant mortality rates.

Studay limitations: The baby with the longest follow-up in our study was 20 months old. It would be appropriate to follow babies until older ages to determine the long-term consequences of CNS anomalies.

Conclusions

CNS anomalies have a wide spectrum. Structural and chromosomal anomalies can often accompany these anomalies. When CNS anomaly is detected in the fetus, all systems should be scanned with detailed US and karyotype analysis should be performed to determine the pregnancy management and prognosis. Since severe CNS anomalies are associated with high morbidity and mortality; Prenatal diagnosis is very important so that families can be offered a pregnancy termination option and those who will continue to be pregnant are informed about the treatment and rehabilitation processes of their babies. US should be the first-choice imaging modality for prenatal diagnosis.

Ethical approval: Ethics Committee permission was obtained from Van Yüzüncü Yıl University Medical Faculty Clinical Research Ethics Committee with the decision dated 14.04.2023 and numbered 2023/04-15.

Conflict of interest: The authors have no conflict of interest regarding this study.

Financial disclosure: No financial support has been received for this study.

Author contributions: Concept (MB, KU, EK, YB), Design (MB, KU, YB), Data Collection and/or Processing (MB, KU, YB), Analysis and/or Interpretation (MB, KU, HGŞ, OK, YB)

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