JCEI /
Journal of Clinical and Experimental Investigations

2013; 4 (2): 141-147
doi: 10.5799/ahinjs.01.2013.02.0254

RESEARCH ARTICLE

Evaluation of fetal ventriculomegaly

Fetal ventrikülomegalinin değerlendirilmesi

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ABSTRACT

Objective: To evaluate the prenatal and postnatal follow up, treatment and the outcome of the patients with ventriculomegaly.

Methods: Patients with lateral cerebral ventricle size 10mm and higher were included. 69 patients were considered but 8 patients refused to join our study. The patients were divided into two groups as they had additional anomalies (combined ventriculomegaly) or not (isolated ventriculomegaly). Each group was divided into three subgroups according to their lateral cerebral ventricle size as mild (10-12 mm), moderate (12.1-4.9 mm), severe (15 mm and more) ventriculomegaly.

Results: 10 fetuses with isolated ventriculomegaly and combined ventriculomegaly died after birth. Neurosurgical operations were performed for ten patients. We performed chromosomal analysis for 16.7% of our patients. Caesarian delivery was higher (91.7%) in combined ventriculomegaly groups and all newborns went to NNICU. In isolated ventriculomegaly group 18 patients showed normal neurological development at sixth month. None of the patients with combined ventriculomegaly group showed normal neurological development at sixth month. In severe ventriculomegaly group termination ratio was higher (64.7%) than isolated ventriculomegaly group (11%). The survival rate was 90% in mild ventriculomegaly group and 42.9% in severe ventriculomegaly group.

Conclusion: Termination is more often in isolated severe ventriculomegaly than mild and moderate ventriculomegaly group because the prognosis is worse. Because the prognosis of the patients with mild ventriculomegaly is good decision for termination will be well evaluated with the family. *J Clin Exp Invest 2013; 4 (2): 141-147*

Key words: Prenatal diagnosis, growth & development, prognosis

ÖZET

Amaç: Fetal ventrikülomegali tanısı alan olguların prenatal, postnatal dönem takip ve tedavi sonuçlarını değerlendirmektir.

Yöntemler: Lateral ventrikül boyutu 10mm ve üzerinde olan olgular çalışmaya dahil edildi. Toplam 69 olgu saptadık ancak bu olgulardan sekizi çalışmamıza katılmayı reddetti. Hastalar ek anomalisi olanlar (kombine ventrikülomegali) ve olmayanlar (izole ventrikülomegali) olarak 2 gruba ayrıldı. Her grup lateral ventrikül boyutuna göre; hafif (10-12mm), orta (12,1-14,9 mm), ağır (15 mm ve üzeri) ventrikülomegali olarak alt gruplara ayrıldı.

Bulgular: İzole ve kombine ventrikülomegalisi olan 10 fetus doğumdan sonra öldü. Onhastaya cerrahi tedavi uygulandı. Hastaların %16.7'sine kromozomal analiz yapıldı. Kombine ventrikülomegalisi olan grupta sezaryen oranı yüksek bulundu(%91.7) ve bu gruptaki hastaların tümü Yenidoğan Yoğun Bakım Ünitesi'ne (YYBÜ) yatış gerektirdi. İzole ventrikülomegalisi olan grupta vaginal doğum daha yüksek bulundu(%45.7).

İzole ventrikülomegalisi olan grupta 18 olgu (%78.3) 6. ayda normal nörolojik gelişim gösterirken kombine ventrikülomegalisi olan grupta hiçbir hastada 6. ayda normal nörolojik gelişim izlenmedi. Ağır ventrikülomegalisi olan grupta terminasyon oranı (%64.7) izole ventrikülomegalisi olan gruptan (%11) daha yüksek bulundu. Hafif ventrikülomegalisi olan grupta sağ kalım %90 ve ağır ventrikülomegalisi olan grupta %42.9 olarak saptandı.

Sonuç: Ağır ventrikülomegalisi olanlarda terminasyon oranı; hafif ve orta ventrikülomegalisi olan gruplardan daha sık gözlendi. Bunun nedeni ağır ventrikülomegalisi olan hastalarda prognozun çok daha kötü olmasıdır. İntrauterin fetal hafif izole ventrikülomegalisi olan olgularda prognoz oldukça iyi olduğundan terminasyon kararının hasta ile iyice irdelenmesi gerektiğini düşünmekteyiz.

Anahtar kelimeler: Prenatal tanı, büyüme ve gelişme, prognoz

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Received: 06.03.2013, Accepted: 03.05.2013

INTRODUCTION

Ventriculomegaly, a nonspecific dilatation of lateral cerebral ventricles, is the most common central nervous system (CNS) abnormality identified with prenatal imaging techniques [1]. The incidence of ventriculomegaly is around 1per 1000 live births [2-3].Ventriculomegaly is described as measuring the cerebral ventricle atrial sizes 10 mm and greater. Ventriculomegaly is divided into two groups: combined or isolated according to additional abnormalities and is divided in to three subgroups according to ventricle size; mild, moderate, severe [8].

Today the outcome of pre- or post-natal ventriculomegaly becomes important because the number of patients with ventriculomegaly increased. Prognosis cannot be determined accurately, since postnatal outcomes of the patients with ventriculomegaly varies widely [4-8]. The prognosis is remarkably affected from the additional anomalies and ventricle size [9]. Ventriculomegaly is usually seen with other chromosomal or CNS abnormalities. However, it can be seen because of intrauterine TORCH infections. Detailed USG examination must be done for ventriculomegaly in order to determine the additional abnormalities. Fetal ECHO must be done to examine congenital heart abnormalities. Fetal chromosomal analysis for chromosomal abnormalities and tests for congenital infections must be done. Fetal MRI is suggested for the patients of which ventriculomegaly is detected on second level USG (10-12]. Fetal MRI is more sensitive than USG in determining CNS abnormalities. The mortality and morbidity have decreased because of the improvements in treatments of children with ventriculomegaly. The better conditions of neonatal intensive care units contribute this as well. The most important mortality reason in ventriculomegaly is additional abnormalities. The most frequent problems that are seen in surgical treatments are infections and blocked shunts.

The aim of this study is to evaluate the follow-up and the treatment of the patients who was diagnosed as ventriculomegaly in our center.

METHODS

The study performed prospectively between March 2007 to April 2008 in Zeynep Kamil Obstetrics and Gynecology Training and Research Hospital. Informed consent for participation to study were taken from all patients and ethics committee approval from the local ethic committee. The patients who were diagnosed ventriculomegaly on ultrasonografic examination in our center or referred from the other centers were included to the study. Sixty nine patients with ventriculomegaly were eligible for the study. Eight patients were excluded because of their refusal to join the study. The patients with cerebral ventricular atrium sizes 10 mm or greater were included to the study. The patients were divided into two groups as they had ventriculomegaly accompanied by other anomalies or isolated ventriculomegaly. Each group was divided into three subgroups according to their lateral ventricle sizes as mild ventriculomegaly [10-12 mm), moderate ventriculomegaly (12.1-14.9 mm) and severe ventriculomegaly (15 mm and higher).

In medical records, maternal age, number of pregnancy, number of birth, number of abortion, and previously affected child with congenital malformations were evaluated. Relevant data were also evaluated such as, first and/or second trimesters' scanning tests, detailed USGs, fetal Echocardiography (ECHO), chromosomal analyses, Magnetic Resonance Imaging (MRIs) if available, pregnancy terminations were investigated. We evaluated ventriculomegaly by serial USG measurements of the pregnancies, which were not terminated. The patients with severe ventriculomegaly were referred Neurosurgery Department. The documents about babies included: gestation weeks, 1. and 5. minute APGAR scores, birth weights, genders, additional malformations, Neonatal İntensive Care Unit (NNICU) acceptations. We inquired the patients whether they had been an operation or not after birth. For assessment of neurological development we used Brunet-Lezine Test in first 30 days and Denver Development Test at sixth month. We followed the patients postnatal 6 to 13 months. The mortality and morbidity rates were evaluated.

Our evaluation principle on ventriculomegaly on continuation of pregnancy was depend on the criterion below;

1. The types; Isolated or combined
2. The gestational age that we determine
3. The severity of ventriculomegaly
4. The parents' choice

When termination was suggested, the patient was referred to the academic committee to inform the parents about the condition. In some cases a Neurosurgeon and Neurologist were included in the committee.

In this study statistical analysis have been done by packet program of NCSS 2007. In assessment of the documents we used variation analysis besides definition statistical methods, in comparisons of the

subgroups we used Tukey multi comparing test, to compare two groups we used student t test, to compare the qualitative documents we used Chi-square test. In results, sensitivity was evaluated on $p<0.05$ level.

RESULTS

Our study has been done with 61 patients. Twenty-seven of 61 patients (43%) were isolated ventriculomegaly, where 34 with (53%) combined ventriculomegaly. When we classified the patients according to their lateral ventricle size we found; 25 cases (41%) mild ventriculomegaly, 4 cases (6.6%) moderate ven-triculomegaly and 32 cases severe ventriculomegaly. In two patients, karyotype analyses showed trisomy 21 and in 1 triploidi (69XXX). There was no statistical difference about median age, pregnancy number, abortion number between isolated and combined ventriculomegaly (Table 1). In isolated ventriculomegaly and in combined ventriculomegaly groups demographic and obstetric parameters are present in table 1 (Table 1). There was no statistical difference about termination time and NNICU acceptance interval be-tween isolated and combined ventriculomegaly groups (Table 1). The initial ventricle size was found sta-tistically higher in combined ventriculomegaly group than isolated ventriculomegaly group (p=0.001, p=0.03) (Table 1). Ventriculomegaly determining time, gestational age at the time of delivery, 1. and 5. minute apgar scores, birth weight medians were statistically higher in isolated ventriculomegaly group (p=0.020, p=0.049, p=0.0001, p=0.03) (Table 1).

Table 1. The qualitative documents about isolated and combined ventriculomegaly groups

	İsolated ventriculomegaly	Combined ventriculomegaly	P
Age (years)	27.63±4.88	25.56±5.03	0.111
Gravidity	(2) 2.3±1.54	(1) 1.79±1.07	0.138
Parity	(1) 1.07±1.33	(0) 0.59±0.86	0.089
Number of babies alive	(1) 0.96±1.13	(0) 0.56±0.82	0.111
Abortion	(0) 0.19±0.4	(0) 0.21±0.54	0.868
First LVG right (mm)	13.05±4.29	17.51±5.23	0.001
First LVG left (mm)	14.25±6.33	18.49±5.84	0.03
Ventriculomegaly determination time	25.81H 2.67 G ±4.67H 2.22 G 26 H 2 G	22.76H 2.62 G ±5.17H 2.32G 22 H 2.5 G	0.020
Termination time	22.67H 1.67 G ±3.06H 1.15 G 22 H 1G	21.14 H 3.18 G±3.14 H 1.71 G 22 H 3 G	0.435
Birth time	38.75H 2.88G±1.45H 2.01G 39 H 3 G	34.5H 3.42 G±10.16 H 2.43 G 38 H 4.5 G	0.049
1.minute Apgar	7.04±1.57	3.67±2.53	0.0001
5.minute Apgar	8.67±0.7	5.67±2.53	0.0001
Birth weight (gram)	3130.83±605.53	2581.67±728.96	0.037
NNICU internation period	38.67±32.44	17.5±27.24	0.163

In combined ventriculomegaly the number of severe ventriculomegaly was higher where as in isolated ventriculomegaly the number of mild ventriculomegaly was higher. The termination rate was higher in combined ventriculomegaly group (64.7%).

Caesarian delivery was statistically high in combined ventriculomegaly group (91.7%) and all newborns were admitted to NNICU. There was no statistically difference about sex between two groups.

Two of 24 patients (8.3%) died in isolated ventriculomegaly group and 8 of 12 patients (66.7%) died in combined ventriculomegaly group. In isolated ventriculomegaly group 4 patients (16.7%) had neurosurgical operation, in combined ventriculomegaly 6 patients (50%) had neurosurgical operation. In isolated ventriculomegaly group, 18 patients (78.3%) normal neurologically development at 6^{th} month. None of the patients with combined ventriculomegaly group showed neurologically development at 6^{th} month (Table 2).

In severe ventriculomegaly group the termination rate was statistically higher. The additional abnormality rate (combined ventriculomegaly) was found statistically higher in severe ventriculomegaly group than mild and moderate groups (Table 3). There was no statistically difference about sex between mild, moderate and severe ventriculomegaly groups (p=0.188). All of the 14 patients with severe ventriculomegaly went to CCINU (Table 3).

Postnatal surgery rate was found statistically higher in severe ventriculomegaly groups (p=0.001). Only 9 of 14 patients (63.7%) had surgery. The other cases have not been treated surgically because they died in early postnatal period or because they were not suitable for surgery. In mild ventriculomegaly group the neurologic deficit rate postnatal and six month was found statistically lower than the others (p=0.006, p=0.002). At sixth month 16 patients (88.9%) in mild ventriculomegaly group showed normal neurological development but there was no patient in severe ventriculomegaly group that showed normal neurological development. The mortality was statistically higher in severe ventriculomegaly group. The survival rate was 42.9% in severe ventriculomegaly group. The survival rate was 90% in mild ventriculomegaly group (Table 4). Lateral ventricle sizes of 2 patients which died after birth were progressively increased through their pregnancies. In mild ventriculomegaly group the patient with severe neurological deficit stayed in NNICU for a long time and metabolic disease was found through this period.

Table 2. The postnatal prognosis of babies with ventriculomegaly

		Isolated ventriculomegaly		Combined ventriculomegaly		
Postnatal surgery	No	20	83.3%	6	50.0%	0.035
	Yes	4	16.7%	6	50.0%	
Postnatal anomaly	No	22	91.7%	9	75.0%	
	Yes	2	8.3%	3	25.0%	0.173
Exitus	No	22	91.7%	4	33.3%	<0.001
	Yes	2	8.3%	8	66.7%	
Postnatal neurological deficits	Normal	20	83.3%	3	25.0%	
	Mild	1	4.2%	4	33.3%	0.001
	Moderate	2	8.3%	0	0.0%	
	Sever	1	4.2%	5	41.7%	
6th Month neurological deficits	Normal	18	78.3%	0	0.0%	
	Mild	2	8.7%	1	20.0%	0.002
	Moderate		0.0%	2	40.0%	
	Severe	3	13.0%	2	40.0%	

Table 3. The prenatal follow up outcomes when grouped according to lateral ventricle size

		Mild ventriculomegaly		Moderate ventriculomegaly		Severe ventriculomegaly		
Groups	İsolated Group	18	72.0%	2	50.0%	7	21.9%	0.001
	Combined Group	7	28.0%	2	50.0%	25	78.1%	
Termination	No	20	80.0%	2	50.0%	14	43.8%	0.021
	Yes	5	20.0%	2	50.0%	18	56.3%	
Birth type	C/S	12	60.0%	0	0.0%	12	85.7%	0.035
	NSD	8	40.0%	2	100.0%	2	14.3%	
Gender	Male	11	55.0%	2	100.0%	5	35.7%	0.188
	Female	9	45.0%	0	0.0%	9	64.3%	
NNICU	No	16	80.0%	2	100.0%	0	0.0%	<0.001
	Yes	4	20.0%	0	0.0%	14	100.0%	

Table 4. The postnatal prognosis when classified according to lateral ventricle size

		Mild ventriculomegaly		Moderate ventriculomegaly		Severe ventriculomegaly		P
Postnatal surgery	No	19	95.0%	2	100.0%	5	35.7%	<0.001
	Yes	1	5.0%	0	0.0%	9	64.3%	
Postnatal anomaly	No	19	95.0%	2	100.0%	10	71.4%	0.124
	Yes	1	5.0%	0	0.0%	4	28.6%	
Postnatal neurological deficits	Normal	18	90.0%	2	100.0%	3	21.4%	
	Mild	1	5.0%	0	0.0%	4	28.6%	0.006
	Moderate	0	0.0%	0	0.0%	2	14.3%	
	Severe	1	5.0%	0	0.0%	5	35.7%	
6th Month neurological deficits	Normal	16	88.9%	2	100.0%	0	0.0%	
	Mild	1	5.6%	0	0.0%	2	25.0%	0.002
	Moderate	0	0.0%	0	0.0%	2	25.0%	
	Severe	1	5.6%	0	0.0%	4	50.0%	
Exitus +/-	No	18	90.0%	2	100.0%	6	42.9%	0.007
	Yes	2	10.0%	0	0.0%	8	57.1%	

Seven patients (70%) of 10 patients who had surgery after birth is still alive. 76.9% normal neurological development was found for these patients after birth. At sixth month severe neurological impairment was 44%, mild impairment was 33%. In all patients shunt treatment as a surgical treatment was performed in first sixth month after birth.

The lateral ventricle size of 9 patients (45%) among 20 patients stayed still through pregnancy. In 3 patients lateral ventricle size increased through pregnancy; there was moderate ventriculomegaly in one (5%) and there was severe ventriculomegaly in two patients (10%). The lateral ventricle size stayed fixed in 2 of 4 patients with moderate ventriculomegaly and in 1 patient ventriculomegaly resolved and become mild ventriculomegaly. In one patient lateral ventricle size increased and become severe ventriculomegaly. None of the patients with severe ventriculomegaly resolved.

DISCUSSION

Nowadays congenital malformation can be determined more often because of the improvements in prenatal diagnostic methods. Ventriculomegaly is the most frequent malformation that can be determined prenatally. Because of the practitioners become more interested in ventriculomegaly follow up and treatment. In combined ventriculomegaly because of the high mortality and morbidity rates parents must be informed about this condition before viability limit if they decide termination. Termination is more often in isolated severe ventriculomegaly than mild and moderate ventriculomegaly because the prognosis is worse.

The isolated ventriculomegaly rate was detected as 50% in studies reported previously [12-15]. In our study isolated ventriculomegaly was found 43% has similar rations to recent studies. We classified the patients according to lateral ventricle size mild ventriculomegaly was 41%, severe ventriculomegaly was 52.5% and moderate ventriculomegaly was 6.6%. In the study of Gaglioti et al they found mild ventriculomegaly 43%, severe ventriculomegaly 34% [8]. When we compare our study with Gaglioti et al the mild ventriculomegaly rate is similar but severe ventriculomegaly rate is higher.

The initial ventriculomegaly determining time was statistically high in isolated ventriculomegaly group. We can determine isolated ventriculomegaly contributed to aquaductal stenosis in 2. or 3. trimester and this can be cause of this difference. In combined ventriculomegaly the initial lateral ventricle size the time of diagnosis was statistically higher from isolated ventriculomegaly group. This difference is because the diagnosis of isolated ventriculomegaly increased in last years [8,12,15,16].

Termination rate was statistically high in combined ventriculomegaly group. Parents chose the termination because of poor prognosis, termination rate in combined ventriculomegaly changes between 50%-80% in different studies.

Pregnancies with hydrocephalus may be terminated by C/S or vaginal route. For vaginal route fetus must be in vertex presentation and head cir-

cumference must be not over 2 SD for that age. If the parents don't want caesarean delivery and the hydrocephalus is with very poor prognosis (alobar haloprosencephalus, hydrancephalia) first cephalosynthesis may be performed before vaginal delivery. In our hospital we give decisions to continue or terminate the pregnancy by evaluating the gestational age, severity of ventriculomegaly and the parents' choice. If termination is wanted, first it is evaluated in the Academic Council then the parents are informed.

If necessary, a neurosurgeon and Neurologist participate in the council. In the literature there is not evidence about the criteria for termination. In combined ventriculomegaly group caesarean delivery is statistically high. It may be related to the additional abnormalities and the higher head the normal circumference. And there are studies that show the prognosis is better with caesarean delivery.

Postnatal survival rate and normal neurological development rate at six month were statistically higher in isolated ventriculomegaly group. In a meta-analyses about isolated ventriculomegaly 30 studies were included and the survival rate was found as 92.7% and where as normal neurological development was found 85% [15]. Postnatal surgery was lower in isolated ventriculomegaly [20]. Because, mild ventriculomegaly showed normal follow up documents postnataly.

In mild ventriculomegaly group the fetuses with additional abnormalities was terminated because of the multiple malformations and chromosomal abnormalities. In mild isolated ventriculomegaly group the survival rate was 90%, postnatal normal neurological development was 90% and normal neurological development at sixth month was 88.9%. Gaglioti et al reported that the survival rate in isolated mild ventriculomegaly 97.7% and normal neurological development 93% [8]. Signorelli et al reported that 100% normal neurological development rate and Pilu et al 96.2% [17,18].

In this study chromosomal analysis was performed on 16.7% of the patients (10 cases). There was chromosomal abnormality in 3 cases (5%).

Pietro et al reported incidence of aneuploidies is high (15%) when severe or borderline ventriculomegaly is associated with additional abnormalities [10].In a review of Melchiorre et al chromosomal abnormality rate was found 2.8% [11]. For the patients with isolated ventriculomegaly chromosomal analysis will be advised for only carefully selected phenomenon. Much more chromosomal analysis must be done for the patients with ventriculomegaly.

There was severe neurological deficit in 4 cases (44.4%), mild deficit in 3 cases (33.3%). The mortality rate after surgical treatment was found 10.2-50% and normal neurological development rate was found 33-59% in the recent studies [20-22].

In our study mortality rate seems to be normal when compared with other studies. But morbidity rate was higher than the other studies [20-22].The reason for this can be the low social and economic conditions of the families.

As a result, termination rate was clearly lower in isolated ventriculomegaly. Because of the good prognosis continuation of the pregnancy is advisable (especially in isolated ventriculomegaly). But these cases may progress during the perinatal period. For this reason, we must remember neurological deficit can develop although lateral ventricle size does not increase.

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