The Incidence of Fetal CNS Anomalies Compared to Other Congenital Anomalies in Cases of polyhydramnios using 3D/4D Ultrasound

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Abstract: **Background**: To determine the incidence and types of fetal anomalies in cases of polyhydramnios detected on 4D ultrasonography. **Methods**: In this analytical study, using 2D/3D/4D ultrasound machine, one hundred and ten diagnosed patients with ultrasonographically detected polyhydramnios were included. Sonographic examination was conducted between 16 to 38 weeks of gestation and fetal anomalies were examined by 2D US and correlated with3/4 D US finding and post natal outcome. **Results**: Out of 110 patients, 40 fetal anomalies were found (36.4%). The age of the patients included in the study ranged from 20to 42 years. the anomalies were found between age group 20 – 38 years with amniotic index range between 25-35. Central Nervous System was the commonest site with fetal anomalies (18.8%) followed by Musculoskeletal (5.5%) CVS (4.5%) and gastrointestinal tract (3.6%). **Conclusion:** Prenatal detection of fetal anomalies has a decisive effect on the outcome of pregnancy and helps the obstetrician in planning the intrapartum management and for post delivery resuscitative measures, if required.

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Key words: Ultrasonography, Polyhydramnios, Fetal anomalies, 3D/4D ultrasound machine.

1. Introduction

Polyhydramnios is characterized by an abnormal increase in quantity of amniotic fluid. Ultrasonographic technique allows for non invasive quantification of amniotic fluid volume. (3) Polyhydramnios can be determined subjectively by observing increased amniotic fluid. This may be confirmed by measuring a single antero-posterior fluid pocket of greater than 8 cm or a four quadrant measurement called amniotic fluid index (AFI) of greater than 25. The most common causes of polyhydramnios are idiopathic, fetal abnormalities, maternal diabetes and twin pregnancies. It is idiopathic in 60 % of cases. It carries a high rate of antenatal and perinatal complications like fetal anomalies, diabetes mellitus, pre eclampsia, threatened abortion and low Apgar scores. (8) The more frequent fetal anomalies are central nervous system, musculoskeletal cardiac, and digestive system (1,7). In polyhydramnios 48% of the fetuses had severe malformations in one study. Ultrasound estimation of amniotic fluid volume is a critical component of antenatal surveillance. (8) Thus targeted ultrasound in the presence of even minor abnormalities of amniotic fluid can significantly improve anomaly detection (2). Three- and 4-dimensional ultrasonography (3D/ 4DUS) has become one of the major modalities used for assessing fetal anomalies (4,5). It allows visualization of fetal structures in 3 orthogonal planes at the same time and different characteristics of the same structure (6).

2. Patients and Methods

This study was carried out at the Beni-Suef university hospital, radio-diagnosis department between April 2016 to February 2018, using Toshiba XARIO ultrasound and the machine containing 3D and 4D image software technologies. One hundred and ten singleton pregnant females with sonographically detected polyhydramnios were included in the study and were evaluated between 16 to 38 weeks of gestation having amniotic fluid index more than 25**.** Pregnant women with multiple pregnancies were excluded. Patients were followed up where possible till delivery/termination of pregnancy. All patients by polyhydramnios submitted to 2D/3D/4D examination and finding correlated to postnatal finding and patients are divided to two groups, normal fetus (controls) and fetus with anomalies (cases), Then incidence of all anomalies, CNS anomalies, Other anomalies related to polyhrdramnios are calculated.

3. Results

The ages of patients ranged from 20 to 42 years. A total of 110 polyhydramnios US diagnosed patients fetal anomalies were found in 40 patients, with five patients having fetuses with more than one anomaly. the incidence of isolated CNS anomalies was 20

(18.8%) and the incidence of CNS anomalies with associates 3 (2.7%). The non CNS anomalies included musculoskeletal 6(5.5%) and CVS 5 (4.5%) then GIT 4 (3.6%). Most of CNS anomalies were chiari malformation 6(5.5%) followed by holoprosencephaly 4(3.6%). There was a highly statistically significant agreement between the prenatal diagnosis by ultrasound and the postnatal confirmed diagnosis clinically or by gold standard diagnostic tools (P-value<0.001). The overall agreement was 95% this meant that the U. S failed to diagnose only 2 cases (5%), these 2 cases were cardiovascular (aortic coarctation) and the other was musculoskeletal (talipus with sacral agenesis). The agreement between 2D ultrasound and 4D ultrasound was 100 %, all prenatal diagnoses done by 2D U.S confirmed by 4D U.S.

4. Discussion

This study shows that the volume data sets obtained with 3D ultrasound examination contain enough anatomic information to distinguish the normal from the abnormal fetus, identify structural anomalies, and accurately diagnose specific anomalies Incidence of among all patients under the study showed that 40 (36.4%) of screened pregnant women with polyhydraminos proved to deliver babies with anomalies on follow up after delivery and 70 (63.6%) delivered normal babies. Mean age of controls 33.03±4.44 years was significantly higher than cases 29.5±4.34 years and also time at examination was higher in controls 29.2±2.08 weeks than cases 26.9±5.25 week, most of cases had positive consanguinity 21(52.5%) than controls 0(0%). There was no statistical significant difference between both groups regarding medical comorbidities (P-value>0.05), evident by that only 8 from 40 cases associated with DM (20%) and 9 from 70 controls (12.9%) and p-value =0.319, also, there was no statistical significant difference between both groups regarding the gravidity and parity (P-value>0.05).

The incidence of isolated CNS anomalies was 20 (18.8%) including chiari malformation 6 (5.5%), isolated hydrocephalus 2(1.8%) holoprosencephaly 4 (3.6%), acrenia 2 (1.8%), dandy walker malformation 3(2.7%), corpus callosum agenesis with colpocephaly 1(0.9%), hydrocephalus with periventricular leukomalacia 1(0.9%) and hydrocephalus with lissencephaly 1(0.9%).

The incidence of CNS anomalies with associates 3 (2.7%). including cyclop with holoprosencephaly 1(0.9%), Amniotic band syndrome and acrenia 1(0.9%) and Unilateral multicystic kidney, left atrium dilatation, hydrocephalus and dandywalker variant 1(0.9%).

The non CNS anomalies 17 (14.9) included:

Musculoskeletal 6(5.5%) including Diaphragmatic hernia 1(0.9%), Sacralageneses and talipus 1(0.9%) Achondroplasia 3(2.7%) and Cleft palat 1(0.9%).

CVS 5 (4.5%), including cystic hygroma 1(0.9%), Aortic coarctation 1(0.9%), Cardiomegaly 1(0.9%), Dextrocardia 1(0.9%) and Cardiomegaly with right ventricular dilatation1(0.9%).

GIT 4 (3.6%) including, Esophageal atresia 3(2.7%) and Duodenal atresia 1 (0.9%).

Multiple non CNS anomalies 2(1.8%) including Hypoplastic left ventricle, ascites with esophageal atresia 1(0.9%) and Cystic hygroma and hydrops1(0.9%).

The incidence of isolated CNS anomalies 20 (18.8%) was significantly higher than the incidence of CNS anomalies with associates 3 (2.7%) (P-value=0.0002), than the non CNS anomalies included musculoskeletal 6(5.5%) (P-value=0.002), than the CVS 5 (4.5%) (P-value=0.001), than GIT 4 (3.6%) (P-value=0.0005) and than multiple non CNS anomalies 2(1.8%) (P-value=0.0001).

This variation may be because of inclusion criterias, as twin pregnancies, maternal diabetes and many other factors can lead to variable results. Associated high incidence of polyhydraminos associated CNS anomalies, with anencephaly and hydrocephalus more common. However GIT anomalies including jejuno- ileal, imperforate anus, tracheo-esophageal fistula and esophageal atresia as well as cardiac septal defects and cleft palate were also recorded. Increased numbers of fetal anomalies (73%) were detected in age group 30 – 40 years (73%) and mostly in multiparous women (83%). (3).

N. F. El Ameenetal study also confirmed our study with near similar the incidence of fetal anomalies in polyhhdramnios, in a prospective study a total of 150 patients, age range from 25 - 40ys. All patients had polyhydramnios and referred from Obstetrics and Gynecology department to radiology department to assess the possibility of intrauterine congenital anomalies. (4).

They showed variable fetal congenital anomalies including CNS anomalies in 22 patients (14.7%), skeletal dysplasia in 20 patients (13.3%), GIT anomalies in 12 patients (8%), cystic hygroma in 10 patients (6.7%), meningocele in 8 patients (5.3 %) and cleft lip in 6 patients (4%). 2D examination showed much less sensitivity in detection of cleft lip anomalies and skeletal dysplasia, where only 2 cleft lip were diagnosed among the 6 detected by 4D and 12 patients with skeletal dysplasia only diagnosed among the 20 detected by 4D and all confirmed after delivery (4).

Table (1) Incidence of CNS and non CNS anomalies among all participants:

Anomalies	Frequency (110)	Percent (100%)
CNS anomalies	**20**	**18.18**
-Chiari malformation	6	5.5
-Hydrocephalus	2	1.8
-Holoprosencephaly	4	3.6
-Acrenia	2	1.8
-Dandywalker	3	2.7
-corpus callosumagensis and colpocephaly	1	0.9
-Hydrocephalus and periventicularleukomalacia	1	0.9
-Hyrocephalaus and lissencephaly	1	0.9
CNS and associated anomalies	**3**	**2.7**
-Cyclope and holoprosencephaly	1	0.9
-Unilateral multicystic kidney, left atrium dilatation, hydrocephalus and dandyalker variant	1	0.9
-Amniotic band syndrome and acrenia	1	0.9
GIT anomalies	**4**	**3.6**
-Esophageal atresia	3	2.7
-Duodenal atresia	1	0.9
Muscloskeletal	**6**	**5.5**
-Diaphragmatic hernia	1	0.9
-Sacral ageneses and talipus	1	0.9
-Achondroplasia	3	2.7
-Cleft palat	1	0.9
Cardiovascular	**5**	**4.5**
-Cystic hygroma	1	0.9
-Aortic coarctation	1	0.9
-Cardiomegaly	1	0.9
-Dextrocardia	1	0.9
-Cardiomegaly and right ventricular dilatation	1	0.9
Multiple non CNS anomalies	**2**	**1.8**
-Hypoplastic left ventricle, ascites and esophageal atresia	1	0.9
-Cystic hygroma and hydrops	1	0.9

Table (2) showed that the incidence of isolated CNS anomalies 20 (18.8%) was significantly higher than the incidence of CNS anomalies with associates 3 (2.7%) (P-value=0.0002), than the non CNS anomalies included musculoskeletal 6(5.5%) (P-value=0.002), than the CVS 5 (4.5%) (P-value=0.001), than GIT 4 (3.6%) (P-value=0.0005) and than multiple non CNS anomalies 2(1.8%) (P-value=0.0001).

Table (3) showed that mean age of controls was significantly higher 33.03±4.44than cases 29.5±4.34 years and also time at examination was higher in controls 29.2±2.08 weeks than cases 26.9±5.25 week.

Fetal abnormalities at 2D and 3D/4D ultrasound are documented (cases). CNS anomalies are grouped versus other anomalies. Statistical analysis and different parameters applied to evaluate the relative incidence. Most of cases 37 from 40(92.5%) had a mild to moderate degree of polyhydraminos and 3 (7.5%) had sever degree. Most of cases were in the third pregnancy 17(from 40) (42.5%) and most of them had 2 children 19 (47.5%). Most of cases were examined at the third trimester 30(75%) and most of patients were free of any comorbidities 32 (80%). Agreement between postnatal confirmed diagnosis and prenatal ultrasound diagnosis of all patients under the study showed that there was a highly statistically significant agreement between the prenatal diagnosis by ultrasound and the postnatal confirmed diagnosis clinically or by gold standard diagnostic tools (P-value<0.001). The overall agreement was 95% this meant that the U.S failed to diagnose only 2 cases (5%), these 2 cases were cardiovascular 1(2.5%) (aorticcoarctation) and the other was musculoskeletal 1 (2.5%) (talipus with sacral agenesis) while positive allover agreement done on 38 (95%) including CNS anomalies 20(50%), Musculoskeletal 5(12.5), Multiple anomalies 5(12.5%), GIT 4(10%) and CVS 4(10%).

Table (4) showed that the incidence of isolated CNS anomalies was 20 (50%) and the incidence of CNS anomalies with associates 3 (7.5%). The non CNS anomalies included musculoskeletal 6(15%) and CVS 5 (12.5%) then GIT 4 (10%). Most of CNS anomalies were chiari malformation 6(15%) followed by holoprosencephaly 4(10%).

Asad Iqbal Mughal et al, show different studies revealed that is incidence of fetal anomalies associated with polyhydramnios range from 31.3% to 38% International studies reveal a varying incidence from 14.5% to 44.5%.

Table (1) showed that the incidence ofof isolated CNS anomalies was 20 (18.8%) and the incidence of CNS anomalies with associates 3 (2.7%). The non

CNS anomalies included musculoskeletal 6(5.5%) and CVS 5 (4.5%) then GIT 4 (3.6%). Most of CNS anomalies were chiari malformation 6(5.5%) followed by holoprosencephaly 4(3.6%).

Table (2) comparison between CNS anomalies and all other systems anomalies regarding their proportion significance

Anomalies	Frequency (110)	Percent (100%)	P-value
CNS anomalies	20	18.18	
CNS and associated anomalies	3	2.7	0.0002*
GIT anomalies	4	3.6	0.0005*
Musculoskeletal	6	5.5	0.002*
Cardiovascular	5	4.5	0.001*
Multiple non CNS anomalies	2	1.8	0.0001*

*P-value is significant

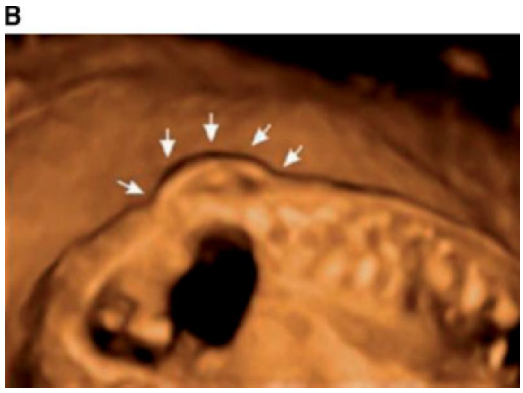
Table (3) comparison between cases and controls regarding age, number of pregnancies, number of children, amniotic fluid index and time at examination:

		N	Mean	Std. Deviation	P-value	Minimum	Maximum
Age	Cases	40	29.95	4.344	0.001*	20	38
	Controls	70	**33.03**	4.440		20	42
Number of pregnancy	Cases	40	2.5750	.93060	0.148	1.00	4.00
	Controls	70	2.8429	.92683		1.00	5.00
Number of children	Cases	40	1.4250	.90263	0.053	.00	3.00
	Controls	70	1.7714	.88746		.00	4.00
Amniotic fluid index	Cases	40	28.2000	2.02801	0.457	25.00	35.00
	Controls	70	27.9571	1.37720		26.00	32.00
Time of examination	Cases	40	26.9000	5.25650	0.001*	16.00	38.00
	Controls	70	**29.2429**	2.08122		24.00	34.00

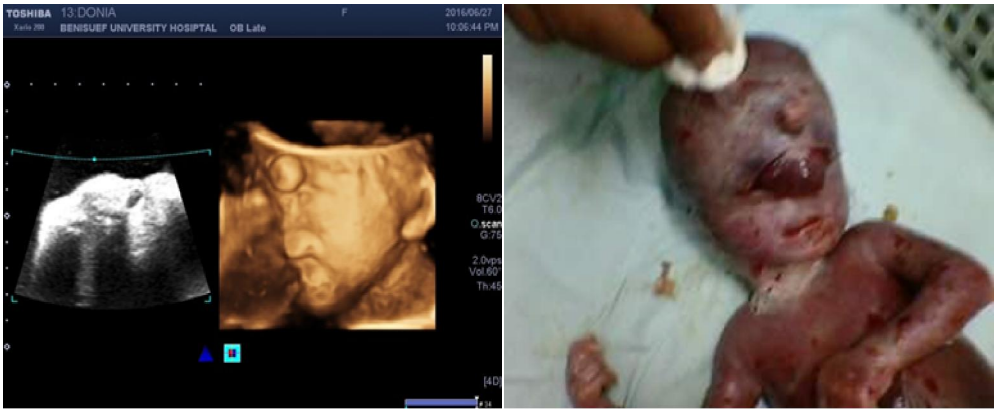
Table (4) Incidence of CNS and non CNS anomalies among the cases (40):

Anomalies	Frequency (40)	Percent (100%)
CNC anomalies	**20**	**50**
-Chiari malformation	6	15
-Hydrocephalus	2	5
-Holoprosencephaly	4	10
-Acrenia	2	5
-Dandywalker	3	7.5
-corpus callosumagensis and colpocephaly	1	2.5
-Hydrocephalus and periventicularleukomalacia	1	2.5
-Hyrocephalaus and lissencephaly	1	2.5
CNS and associated anomalies	**3**	**7.5**
-Cyclope and holoprosencephaly	1	2.5
-Unilateral multicystic kidney, left atrium dilatation, hydrocephalus and dandyalker variant	1	2.5
-Amniotic band syndrome and acrenia	1	2.5
GIT anomalies	**4**	**10**
-Esophageal atresia	3	7.5
-Duodenal atresia	1	2.5
Muscloskeletal	**6**	**15**
-Diaphragmatic hernia	1	2.5
-Sacral ageneses and talipus	1	2.5
-Achondroplasia	3	7.5
-Cleft palat	1	2.5
Cardiovascular	**5**	**12.5**
-Cystic hygroma	1	2.5
-Aortic coarctation	1	2.5
-Cardiomegaly	1	2.5
-Dextrocardia	1	2.5
-Cardiomegaly and right ventricular dilatation	1	2.5
Multiple non CNS anomalies	**2**	**5**
-Hypoplastic left ventricle, ascites and esophageal atresia	1	2.5
-Cystic hygroma and hydrops	1	2.5

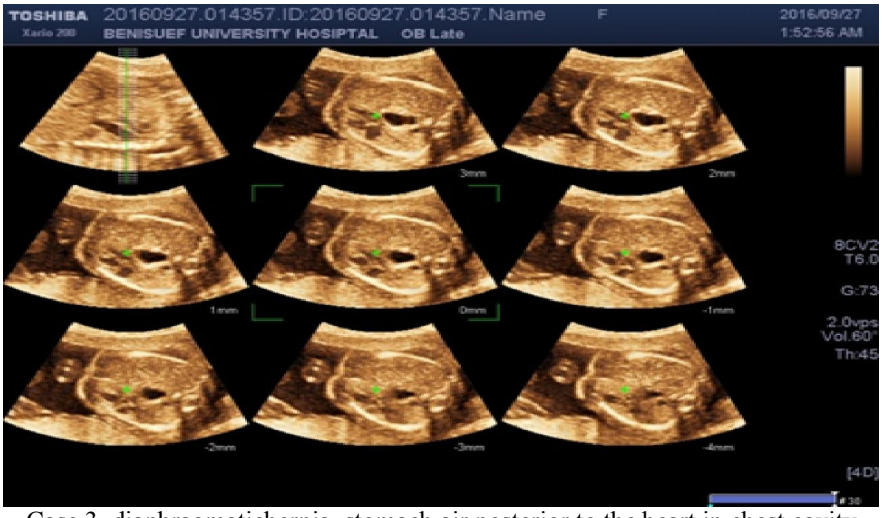
Images for this section:



Case 1; chiari malformation, Lumbosacral spina bifida with meningiocele



Case 2, cyclopia with holoprosencephaly



Case 3. diaphragmatichernia, stomach air posterior to the heart in chest cavity

Conclusion

Ultrasound examination in polyhydramnios is useful in detecting fetal anomalies and helps predict fetal prognosis and to devise a proper management plan. more studies and researches are needed especially with more sample size and time to more accurate estimation for relative incidence of different fetal anomalies in cases of polyhydramnios, yet any way this study confirms that the 3D/4D ultrasonography is an accurate and reliable method for

prenatal diagnosis of fetal defects especially if used by expert hands.

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