

Evaluation of Amniotic Fluid volume with Ultrasound at Term Pregnancy and its Correlation to Perinatal outcome

Abdulrazak H. Alnakash *, Areej Sabah Abdul Ridha**

ABSTRACT:

BACKGROUND:

recognition of abnormal amniotic fluid volume before delivery may alert the clinician to situations of potentially high prenatal risk. pregnancies complicated by extremes of amniotic fluid volume also experiences increase maternal & neonatal morbidity.

OBJECTIVE:

To identify the incidence of fetal morbidity & mortality associated with abnormal liquor volume compared with those having normal liquor volume at term pregnancy.

Study design: A prospective cohort study.

Setting: The study was conducted at Al-Elwiya Maternity Teaching Hospital, during the period from Mar. 2011 to Apr. 2012.

PATIENTS AND METHODS:

Three hundred fifty one pregnant women at their term were collected for the study. The participants were classified according to the amniotic fluid volume into 3 groups: Group 1: (244) those with normal liquor volume (maximum vertical pocket 3-8 cm), Group 2: (63) those with oligohydramnios (maximum vertical pocket <3cm), Group 3: (44) pregnant having polyhydramnios (maximum vertical pocket > 8 cm). Multiple pregnancy, preterm, postterm pregnancy or those with ruptured fetal membranes had been excluded. The fetal outcome of the groups were analysed & data arranged in tables & subjected to statistical study.

RESULTS:

In oligohydramnios group, hypertensive disorders & IUGR were 17.4% & 9.52% respectively, while in polyhydramnios women with diabetes diseases were 22.7% versus 1.64% in the control group. In oligohydramnios group, low birth weight, intrapartum complications & admission to NICU were more significant with incidence of 9.59%, 39.6%, 46% respectively versus 0.04%, 5.33%, 11.07% for control respectively. Fetal congenital anomalies, early neonatal complications, macrosomia, low Apgar score & early neonatal death were more in polyhydramnios group as follow: 18.18%, 29.25%, 15.9%, 18.18% & 9.09% respectively compared with the control which were 0.41%, 8.6%, 5.74% respectively & there were no recorded cases of low Apgar score or early neonatal complications in the control group.

CONCLUSION:

Largest vertical pocket less than 3cm at term is associated significantly with higher incidence of hypertensive disorders & IUGR. It was highly significant in predicting neonatal admission (NICU) & intrapartum complications. While when the largest vertical pocket is more than 8cm, diabetes disease, fetal macrosomia, congenital anomalies, low Apgar score, early neonatal complications & neonatal death are more frequently seen.

KEY WORDS: amniotic fluid, oligohydramnios, polyhydramnios.

INTRODUCTION:

Amniotic fluid is produced by the fetus & surround it throughout the pregnancy it provides: protection for fetus from injury, prevents compression of the umbilical cord, allows room for it to move & grow⁽¹⁾ and provides an even temperature to the fetus⁽²⁾. Ingestion of the fluid

into gestational tract & inhalation into the lung may promote growth & differentiation of these tissues and It has a bacteriostatic action. In labour; the even distribution of fluid makes possible for the force of uterine contraction to applied early on the cervix. Amniotic fluid is the net result between inflow & outflow of fluid into the amniotic cavity^(3,4).

By term fetus produces an average from 500-700ml/day with a slight decline in hourly fetal urine production after 40 weeks gestation⁽⁵⁾. Any

*Alkindy Medical College/ Baghdad University
Al-Elwiya Maternity Teaching Hospital.

**Candidate of Arab Board Degree
Al-Elwiya Maternity Teaching Hospital.

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condition that prevent fetal urine production like renal agnesis and renal dysplasia or bladder outlet obstruction, will cause oligohydramnios ⁽⁶⁾. Any condition that cause increase fetal urine production as maternal diabetes may cause polyhydramnios ⁽⁷⁾.

Amniotic fluid gradually increases as pregnancy progress, at 12 weeks gestation, the average volume is 60ml. By 16 weeks, mean volume is 200ml, with a plateau production a mean volume usually around 770-80ml between 24-37 weeks of gestation and by 40 weeks the total fluid volume will be decline to less than 600 ml & by 41 weeks of gestation to around 500 ml ⁽⁸⁾.

In 1981, Manning et al. introduced the concept of Amniotic fluid volume (AFV) determination using the depth of the maximum vertical pocket (MVP) visible on ultrasound. They defined "oligohydramnios" as a MVP less than 1cm & "reduced" AFV as a pocket 1 to 2 cm in depth ⁽⁹⁾. Chamberlain et al. later defined a normal MVP of 2cm to 8cm. Measurement below 2cm would suggest oligohydramnios ⁽⁹⁾. Those above 8 cm should be classified as hydramnios. while Halperin et al. & Crowley et al. used a 3cm single pocket of amniotic fluid as a cut- off between normal AFV & oligohydramnios ⁽¹⁰⁾.

Amniotic fluid index (AFI), proposed by Phelan et al. In 1987 ⁽¹¹⁾. This method is based on the sum total of the deepest vertical pocket in each of the 4 quadrants into which the uterus is divided. The amniotic fluid index is considered normal when equal to 8.1cm & regarded high when more than 18cm. Unlike Moor & Cayle who claimed that a less than 5cm defines olighydramnios ⁽¹²⁾.

The aim of this study is to determine the relation between amniotic fluid volume (measured by largest deepest pocket), fetal morbidity & mortality in term pregnancy.

MATERIALS AND METHODS:

A Cohort prospective study conducted at AL-Elwiya Maternity Teaching Hospital in Baghdad between Mar. 2011 & Apr. 2012.

The study protocol was approved by the Obstetrics & Gynecology Supervising Committee of Arab Board for Medical Specialization.

The study sample consisted of 351 term pregnant ladies (completed 37wks-41wks+6days gestation) in their 1st stage of labor as well as those admitted for elective cesarean delivery, with intact fetal membranes, all the enrolled women in the study had delivery within 48 hours after sonographic examination. Multiple pregnancies, preterm and Postterm Pregnancies, had been excluded from the study.

All participants were subjected to clinical examination & routine investigations after full history taking. A verbal consent was taken from them after explaining the idea of the study. Ultrasound examination was done at the Department of Radiology using device with convex transducer frequency of 3.5 MHz (Braun, U.K.). Amniotic fluid volume measurement was done by measuring the largest vertical pocket. The uterus divided into 4 imaginary quadrants, the linea nigra and the umbilicus serves as a dividing point fig 1. Transducer is kept always parallel to patients longitudinal axis & perpendicular to the floor. The largest clear amniotic fluid free of umbilical cord or fetal limbs was measured & recognized as the deepest pocket, (fig.2).

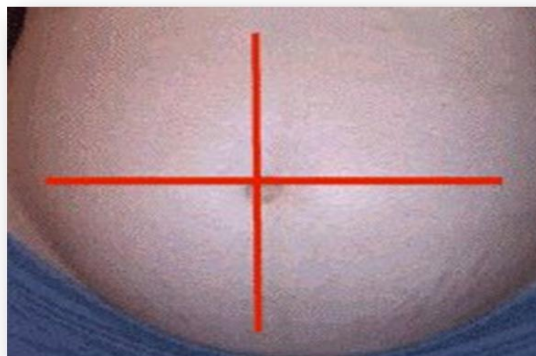


Fig. 1:Measurement of DVP of amniotic fluid by dividing uterus into 4 quadrants.

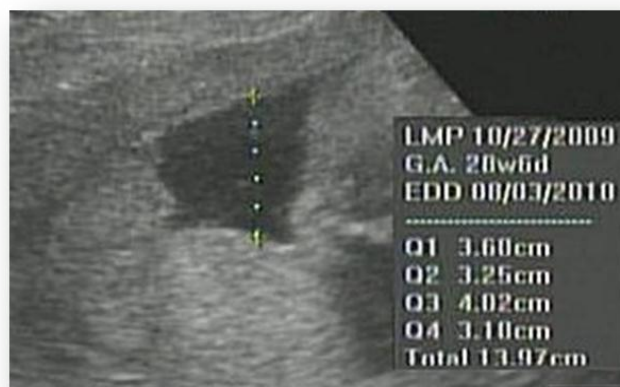


Fig. 2 : Ultrasound measurement of DVP of amniotic fluid.

The participants were grouped according to ultrasound measures as follows:

1. Group1, Control group: largest vertical pocket is 3–8 cm.
2. Group2, Oligohydramnios group: largest vertical pocket is less than 3 cm.
3. Group 3, Polyhydramnios group: largest vertical pocket is larger than 8 cm.

Labor or cesarean section was attended by the researcher, complete labor record with mode of delivery & duration were plotted on the partogram. Examination of the newborn baby in combination with pediatrician was done & also recording of: Apgar score, any anomalies, any resuscitation was carried out on the baby, admission, indication for admission to NICU & early neonatal complications, all these parameters were used to evaluate the perinatal outcome.

Diagnosis of adverse perinatal outcome depend on:

1. Intrapartum Complications:
 - a. Fetal distress: identified by abnormal intrapartum fetal heart rate monitoring such as: late deceleration, persistent variable deceleration, prolonged decelerations or fetal bradycardia with loss of variability.
 - b. Failure of progress of 1st or 2nd stage of labour: accepted labor progress is 1-1.5 cm per hour (cervical dilation & / or descent of the presenting part) after satisfactory uterine activity. This can be required 6-8 hours before cesarean delivery is performed for dystocia.
 - c. Meconium stained liquor.
 - d. Shoulder dystocia.
2. Apgar score: at 5th minute less than 7.
3. Newborn weight: A newborn weight is less than 2.5 kg it categorized as low birth weight,

while macrosomia is considered when newborn weight exceed 4 kg.

4. Neonatal intensive care unit admission.
5. Early neonatal complications: Respiratory distress syndrome (RDS), Transient tachypnic attack (TTN), jaundice, seizure, hypoglycemia, Meconium Aspiration syndrome (MAS).
6. Presence of neonatal congenital anomalies.
7. Early neonatal death.

Statistical analysis:

The data were collected & arranged in tables, then analysed using:

1. Descriptive statistics: tables, graphs, frequency, percentage & standard deviation.
2. Inferential statistics : chi square test & one way Anova (F test) were used to find associated the related variables.

Data were entered & analysed by MINI TAB software . Pvalue < 0.05 was considered statistically significant.

RESULTS:

Three hundred and fifty one pregnant ladies were included in the study and were grouped according to ultrasound measurers into 3 groups: 244 (69%) as group 1 (control), 63 (18%) as group 2 (oligohydramnios) & 44 (13%) as group 3 (polyhydramnios), fig 3 (scale of the sample group in the study).

Table 1: shows maternal characteristics. Maternal age ranged between 14 to 45 years, the mean maternal age was 26.7 years.

There was no significant difference between amniotic fluid volume & maternal age. P value was 0.452 , while there was significant difference between polyhydramnios & multiparity, p value 0.027.

Thirty seven women (10.54%) in the study were hypertensive (chronic hypertension, gestational

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hypertension & preeclampsia), 25 (10.25%) of them were in group 1, 11 (17.46%) were in group 2 & 1 (2.27%) was in group 3.

There was significant difference between hypertensive disorders & reduction of amniotic fluid volume, P value = 0.043.

Fourteen women (3.9%) in the study were either pregestational or gestational diabetic, 10 (22.73%) were in group 3 versus 4 (1.64%) were in group 1, so there was a significant difference between increase amniotic fluid volume and diabetes, P value= 0.0001.

Six cases (1.71 %) of IUGR were seen in the study, all of them were in group 2 with incidence of 9.52 % .

Tables 2: shows the mode of delivery. One hundred women(33.3 %) delivered by cesarean delivery, 27(42.86 %) were in group 2 & 28 (36.64%) were in group 3 versus 62(25.41%) were in group 1. There was a significant difference between amniotic fluid volume reduction & increase rate of cesarean delivery, P value = 0.001.

Fig 4: chart for indication for cesarean delivery, we noticed that the most common indication for cesarean delivery in group 2 was fetal distress (30.16%) versus group 1 the incidence was 1 (3.28%) & was no recorded case in group 3 , while most common indication for cesarean delivery in group 3 were malpresentation & abnormal lie (36.36%) versus group 1 (2.87%). There were 4 cases of hydrocephaly in the study all delivered by cesarean delivery & all of them were group 3 (9%).

Table 3: shows intrapartum complications & neonatal outcome.

Intrapartum complications have been seen in 43 (12.25%) cases in the study (fetal distress, failure of progress, meconium stained liquor & shoulder dystocia).

Fig 5: chart for intrapartum complications, most common complications were seen in group 2 & group 3; 25 (39.6%)& 5 (11.36%) respectively versus 13 (5.33%) cases in group 1. Fetal distress & meconium stained liquor were the most common intrapartum complications in group 2 as follows: 19 (30%) & 10 (15.8%) respectively. In group 3 most common intrapartum complications

were shoulder dystocia 3 (6.8%). There was significant difference between amniotic fluid reduction & intrapartum complications, P value = 0.0001.

In this study there were 8 newborn babies with 5th. min. Apgar score less than 7, all of them in group 3 with of incidence 18% & there were 7 newborn babies delivered with weight less than 2.5 kg, 6 of them were in group 2 (9.59%) & only one in group1 (0.4%), while 21 newborn babies delivered with weight more than 4 kg, 7 of them were in group 3 (15.9%) versus 14 were in group 1(5.7%).

Ten babies In the study (2.85%) delivered with congenital anomalies; 1 (0.41%) was in group 1, (cleft lip) , 1 (1.59%) was in group 2, (congenital heart disease) & 8 babies have been seen in group 3 (18.18%); 2 babies with NTD, 4 babies with Hydrocephaly, 1 baby with GIT abnormalities & 1 with multiple congenital anomalies. There was significant difference between increase amniotic fluid volume & newborn congenital anomalies, P value = 0.0001.

In the study 71 (20.23 %) newborn babies were admitted to NICU, 27 (11.07%) were in group 1, 29 (46.03%) were in group 2 & 15 (34.09%) were in group 3.

There was significant difference between decrease amniotic fluid volume & admission to NICU. P value=0.0001. Five newborn babies were referred to pediatric surgical center, all of them were in group 3 (11.36%). In the study there were 4 cases of early neonatal death all of them were in group 3 with incidence of (9.09%). So there was significant difference between increase amniotic fluid volume & increase perinatal morbidity & mortality.

Regarding early neonatal complications (TTN, RDS, jaundice, MAS & hypoglycemia), there were 49 (13.9%) neonates with early neonatal complications: 21 (8.6%) were in group 1, 15(23.8%)were in group 2 & 13 (30%) were in group3 as seen in [fig 6](#): chart for early neonatal complications, so There was significant different between increase amniotic fluid volume & early neonatal complications, P value=0.0001.

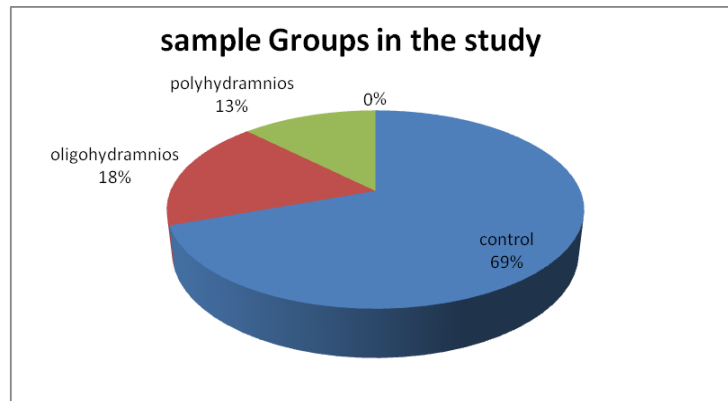


Fig.3 : Scale of sample groups in the study

Table 1: Maternal characteristics.

characteristic	G1 n=244	G2 n=63	G3 n=44	Total n=351	P value
Age-mean (min.-max.)	26.82(16-45)	25.25(14-37)	28.54(18-42)	26.75(14-45)	0.452
Primi (n.)	61 (25%)	24 (38.10%)	7(15.91%)	92(26.21%)	
Multi (n.)	183(75%)	39(61.9%)	37(84%)	259(73.7%)	0.027
Hypertensive disorders	25(10.25%)	11(17.46%)	1(2.27%)	37(10.54%)	0.043
Diabetes disease	4(1.64%)	0	10(22.73%)	14(3.99%)	0.0001
I UGR	0	6(9.52%)	0	6(1.71%)	

Table 2 : Mode of delivery.

Route of delivery	G1 n(perc.)	G2 n(perc.)	G3 n(perc.)	Total n(perc.)	P value
Vaginal	182(74.5%)	36(57.14%)	16(36.36%)	234(66.67%)	
Cesarean	62(25.41%)	27(42.86%)	28(36.64%)	117(33.33%)	0.001

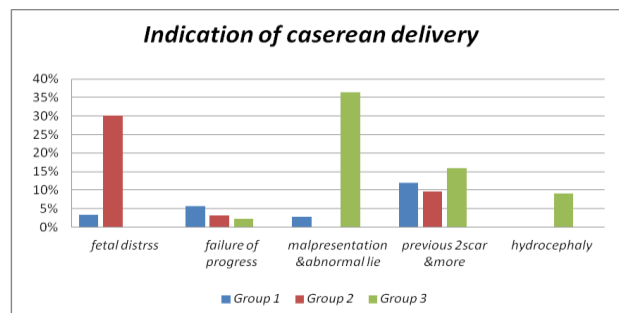


Fig. 4: Chart for indication of cesarean delivery.

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Table 3: Intrapartum complications & Neonatal Outcome.

Characteristic	G1 n=244	G2 n=63	G3 n=44	Total n=351	P value
Intrapartum complications	13(5.33%)	25(39.68%)	5(11.36%)	43(12.25%)	0.0001
5 min. APGAR score <7	0	0	8(18.18%)	8(2.27%)	
Congenital anomalies	1(0.41%)	1(1.59%)	8(18.18%)	10(2.85%)	0.0001
Newborn wt.<2.5 kg	1(0.4%)	6(9.59%)	0	7(1.99%)	
Newborn wt.2.5-4kg	229(93.8%)	57(90.4%)	37(84.09%)	323(92.02%)	0.165
Newborn wt. >4kg	14(5.74%)	0	7(15.9%)	21(5.98%)	
Admission to NICU	27 (11.07)	29 (46.03)	15 (34.09)	71 (20.23)	0.0001
Admission to NICU & discharge <24 h	20(8.20%)	10(15.87%)	1(2.27%)	31(8.8%)	
admission to NICU&discharge>24h	7(2.87%)	19(30.16%)	5(11.36%)	31(8.83%)	0.0001
Referred to paediatric surgical center	0	0	5(11.36%)	5(1.24%)	
Dead	0	0	4(9.09%)	4(1.14%)	
Early neonatal complications	21(8.61%)	15(23.8%)	13(29.54%)	49(13.9%)	0.0001

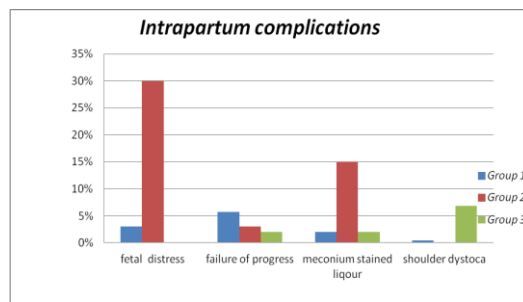


Fig.5: Chart for intrapartum complications.

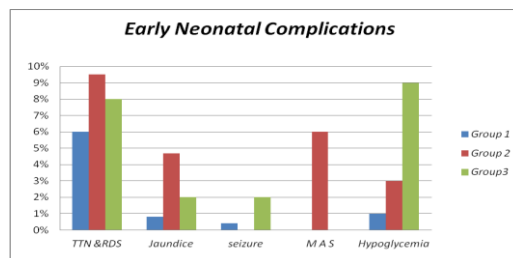


Fig. 6: Chart for early neonatal complications.

DISCUSSION:

Estimation of amniotic fluid volume is an integral part of antenatal fetal surveillance. Recognizing abnormal amniotic fluid volume before delivery may alert the clinician to situation of potentially high perinatal risk^(3,4).

In the study, the women with oligohydramnios constituted 18% and polyhydramnios were 13% of the study sample. These figures go with the study of Magaan et. Al⁽¹³⁾ and Rainford et. Al⁽¹⁴⁾ who reported that the incidence of

oligohydramnios in pregnant women approximately reaches 20%, and 19% respectively.

Regarding polyhydramnios, the study disagrees with Saadia T.⁽¹⁵⁾, Bryan M.⁽¹⁶⁾, Hill et. Al⁽¹⁷⁾ and Biggio JR et al⁽¹⁸⁾ who reported the incidence of polyhydramnios in pregnant women were 2.19%, 1% , 0.9% and 1%, respectively. This high incidence of polyhydramnios reported in our study might be attributed to that most cases

in the study sample were referrals, so the result could have been biased toward the most severe cases & does not represent the actual incidence.

No significant relation between amniotic fluid disorder & maternal age, but there was significant relation between polyhydramnios & multiparity. Saadia T.⁽¹⁵⁾ reported that majority of women presented with polyhydramnios were multigravida Anisa F.⁽¹⁹⁾, claimed that 21% of polyhydramnios were primigravida, 57% multigravida & 21.4% grandmulti.

A significant relation was seen between oligohydramnios & hypertensive disorder with incidence of 16.4%, p value 0.043 & also for IUGR, with incidence of 9.5%. This agrees to some extent with studies of: Akhter H.⁽²⁰⁾, who observed that the frequency of different risk in pregnancies with oligohydramnios included: 50% pregnancy induce hypertension, 10% chronic hypertension & 30% IUGR, Chamberlain et. Al⁽⁹⁾, noted a higher incidence of IUGR in oligohydramnios women with incidence of 36%. Incidence of cesarean delivery in oligohydramnios women was 33.1% , the most indication was fetal distress with incidence of 30.16%. These results agree with Charu J.⁽²¹⁾, he reported that 56% of women with oligohydramnios underwent cesarean section, 42% of them for fetal distress, Casey et. A⁽²²⁾, found that 32% of oligohydramnios women delivered by cesarean section and Chauhan et. Al⁽²³⁾ reported that oligohydramnios increased risk for cesarean section, 56% of sections were for fetal distress.

Oligohydramnios was associated with increase intrapartum complications, with incidence of 49%; fetal distress & meconium stained fluid were the most common with incidence of 30%, 15.8% respectively. These results agree with the study of Ott Wj⁽²⁴⁾ who concluded that the risk of non-reassuring FHR pattern during labor was increase in oligohydramnios, Chauhan et. Al⁽²³⁾ demonstrated that incidence of meconium stained fluid & variable deceleration increased in oligohydramnios women & meconium stained fluid incidence which was 48%.

Incidence of low birth weight (<2.5 kg) in oligohydramnios was 9.5% versus control group which was 0.4%. These results go for the study performed by Casey et.al⁽²²⁾, who reported that birth weight is significantly less in infant of oligohydramnios. Akhter H.⁽²⁰⁾ reported high incidence of low birthweight in oligohydramnios women reached 60% versus control 40%. There was only one recorded case of congenital

anomaly giving an incidence of (1.59%) & no neonatal death in oligohydramnios group. This result agree with the studies of Kreiser et.al⁽²⁵⁾ & MJ Morris et.al⁽²⁶⁾, they did not report any perinatal death in oligohydramnios & disagree with Casey et. al⁽²²⁾ who noted 10% perinatal death & significant incidence of congenital syndrome.

Incidence of early neonatal complications (TTN, RDS, jaundice, MAS & hypoglycemia) was 23.8% in oligohydramnios versus 8.6% in control group, the most complications were : (TTN & RDS) & MAS with incidence of 9.3% & 6% respectively. Such results agree with Casey et.al⁽²²⁾, who reported significant relation between oligohydramnios & MAS and disagree with study of Ott Wj⁽²⁴⁾, who concluded that there was no significant relation in the incidence of neonatal complications in oligohydramnios comparing with control group.

There were 14 women (3.9%) with either pregestational or gestational diabetes mellitus out of 10 cases (22.7%) were in polyhydramnios group versus 4 cases (1.64%) in control, there was significant difference between amniotic fluid volume & diabetic diseases. Saadia T.⁽¹⁵⁾, in his study concluded that 26.8% of polyhydramnios women had an impaired glucose tolerance test, Naser O.⁽²⁷⁾ considered diabetes as a cause for polyhydramnios with incidence of 24.4% & Biggio⁽¹⁸⁾ reported that the incidence of hydramnios was significantly higher in diabetic women 5.8% versus non diabetic 0.84%.

Incidence of cesarean delivery in polyhydramnios group was 36.64 versus control group which was 25.41%, the most common indication for cesarean section was malpresentation & abnormal lie (36.36%) versus (2.87%) in control group. There was no recorded case of fetal distress as an indication for cesarean delivery. This might be due to that most cases (other than malpresentation & abnormal lie) were suspected to be macrosomic, so the threshold for cesarean delivery was narrow that limited fetal distress as an indication for cesarean section.

Babies delivered with macrosomia (Wt > 4 kg) were 15.9% in polyhydramnios versus 5.7% in the control group this nearly goes with Naser O.⁽²⁷⁾ who reported that in polyhydramnios women the incidence of malpresentation was 11.6%, macrosomia 20.3% & cesarean section 24.6%. Regarding the high incidence of macrosomia in polyhydramnios and we agree with Biggio⁽¹⁸⁾, who noticed that cesarean delivery rate was 3 times higher in polyhydramnios compared with

control group 47% versus 16.4% respectively, but we disagree with him regarding the indication for cesarean delivery, he noted that non-reassuring FHR tracing was 4 folds in polyhydramnios women, also he reported that no difference regarding malpresentation in polyhydramnios compared with control group.

In this study, 8 babies (18.8%) were delivered with congenital anomalies in polyhydramnios group (2 babies with NTD, 4 with hydrocephaly, 1 with GIT abnormalities & 1 with multiple congenital anomalies). There was significant difference between increase amniotic fluid volume & newborn congenital anomalies p value 0.0001. Similar conclusion reported by Saadia T.⁽¹⁵⁾, who noted that fetal congenital anomalies incidence 31.7% in polyhydramnios women and Biggio⁽¹⁸⁾ who found that hydramnios had 25 times more anomalies than control, incidence was 8.4% versus 0.3%.

We had 8 newborn babies (18%) delivered with low Apgar score & 15 (34%) newborn babies admitted to NICU and regarding neonatal death, we had 4 cases, all of them were in hydramnios group with an incidence of 9.09% . In group 3, (30 %) of the newborn babies had early neonatal complications versus (8.6%) in control group. There was a significant relation between increased amniotic fluid volume & e perinatal morbidity & mortality, this finding goes with Hill et. Al⁽¹⁷⁾ study who recorded 13 cases of perinatal death.

CONCLUSION:

LVP< 3cm in term pregnancy was associated significantly with higher incidence of hypertensive disorders & IUGR. It was highly significant in prediction NICU admission & intrapartum complications. While LVP > 8cm was more frequently associated with diabetes diseases, fetal macrosomia, congenital anomalies, low Apgar score, early neonatal complications & neonatal death.

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