Original Article

The Etiological Factors of Polyhydramnios in Pregnant Women in Minia Governorate. A Prospective Cross Sectional Study

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Abstract

Background: The amniotic fluid is required for the proper growth and development of the fetus, and it also acts as a barrier against infection and helps in fetal lung maturity. It varies with gestational age. Polyhydramnios is the excess of the amniotic fluid relative to the gestational age, which may be associated with adverse fetal and maternal outcomes.

Aim: to detect the etiological factors of polyhydramnios in the Minia governorate with limited tools.

Subjects and methods: This prospective study was conducted in the department of Obstetrics & Gynecology at Minia University. A group of 100 pregnant ladies irrespective of gestational age with an amniotic fluid index of more than 20 was included in the study.

Results: the mean AFI was 30.3 ± 6.1 among the participants. 46% had mild polyhydramnios, 28% had moderate polyhydramnios and 26% had severe polyhydramnios. There 14% had turbid amniotic fluid among the participants.

Conclusions: Women with polyhydramnios had an increased risk for delivery by a cesarean section. Both diabetes mellitus and gestational diabetes are the main risk factors of polyhydramnios. Polyhydramnios were associated with gestational age at late-term and neonatal birth weighted > 2.5 Kg and NICU admission.

Key words: Amniotic; Polyhydramnios; Diabetes; Caesarean

Introduction

Amniotic fluid surrounds the embryo and fetus during development and has a myriad of functions. Physically, it protects the fetus against trauma. Furthermore, it protects the umbilical cord by providing a cushion thus reducing the risk of compression between the fetus and the uterine wall. Amniotic fluid also helps protect the fetus from infectious agents due to its inherent antibacterial properties [1]. Additionally, it serves as a reservoir of fluid and nutrients for the fetus. Clinicians can use amniotic fluid as a tool to monitor the progression of pregnancy and predict fetal outcomes [2].

Abnormally high or low amniotic fluid volumes have been shown to predict poor fetal outcomes; therefore, a normal amount of amniotic fluid volume is crucial to the healthy development of the fetus or embryo. Amniotic fluid has proven to be a major diagnostic tool when monitoring the progression and health of a pregnancy. Clinicians can use

the amniotic fluid index (AFI) or single deepest pocket (SDP) [3].

An AFI of greater than 20 cm or an SDP of more than 8 cm is considered polyhydramnios. Polyhydramnios can be caused by gastrointestinal tract obstruction, genetic disorders, musculoskeletal disorders, or congenital diaphragmatic hernias [4]. It represents a high-risk obstetric condition with increased perinatal and maternal morbidity and mortality due to a higher incidence of intrauterine fetal demise, preterm labor, premature rupture of membranes, cord prolapse, fetal macrosomia, breech presentation, cesarean delivery, and postpartum hemorrhage. In pregnancies affected by polyhydramnios, approximately 20% are due to a congenital anomaly; however, 60% to 70% are idiopathic with no identified underlying cause [5]. Other complications of polyhydramnios may be correlated directly with the disease processes which altered the normal amniotic fluid equilibrium resulting in

increased amniotic fluid. Fetal macrosomia, which is commonly seen in gestational diabetes, is an increased risk factor for neonatal hypoglycemia, shoulder dystocia, and cephalopelvic disproportion requiring cesarean delivery [6].

Polyhydramnios occurs in 1% to 4% of all pregnancies. It is often identified incidentally in the asymptomatic patient during sonographic evaluation for other conditions in the third trimester. Idiopathic polyhydramnios is often a self-limiting condition but, rarely, a cause for increased AFV may be discovered after birth. Idiopathic polyhydramnios is less likely to be associated with an underlying disease process. However, an underlying disease or congenital anomaly has been identified in 91% of cases with more severe polyhydramnios and these patients are more likely to be symptomatic due to significant AFV [7]. Although mild polyhydramnios is often idiopathic, reported causes of moderate and severe polyhydramnios include: fetal malformations and genetic anomalies (8-45%), maternal diabetes mellitus (5-26%), multiple pregnancies (8-10%), fetal anemia (1-11%), and other causes, including viral infections, Bartter syndrome, neuromuscular disorders and maternal hypercalcemia [8].

Aim of the Work: to detect the etiological factors of polyhydramnios in the Minia governorate with limited tools.

Methods

Study setting:

The study had been conducted at the obstetrics and gynecology department, Minia maternity university hospital. This Prospective study included 100 pregnant ladies respective of gestational age more than 22 weeks with amniotic fluid index more than 20cm had been included in the study to detect the etiological factors of polyhydramnios in Minia Governorate and which type is common here in our country within limited tools which include

ultrasonography ,4D ultrasonography and the routine laboratory investigations.

Inclusion Criteria for study group involved any pregnant woman met one or more of the following: a) Above 22 weeks (gestational age will be calculated by L M P or by first trimester Ultrasonography). b) Intact membranes. c) Polyhydramnios detected by Ultrasonography (fluid Index more than 20 cm). d) Polyhydramnios with previous history of congenital anomaly. During the study we will select our cases of polyhydramnios by doing Percentile curve of assessment of amniotic fluid for them as in this table.

Exclusion Criteria for groups included gestational age <22 weeks, premature rupture of membrane (PROM), vaginal bleeding, and acute polyhydramnios. The procedure was well-explained to all women participating in the study. A written consent was taken from all patients before starting the study with counseling about risk and benefit of study.

Patients were subjected to; complete history taking including: 1. Personal history such as name, age, marital state, address, menstrual history: like the age of Menarche, menstrual disturbance, dysmenorrhea, related symptoms. 2. Obstetric history including parity and mode of delivery. 3. History of period of gestation. d) History of last menstrual period and expected date of delivery. 4. History of previous pregnancies. 5. Present history: of chronic diseases and medication. 6. Past history of HTN, DM. 7. Family history of similar condition or diabetes. 8. History of allergy to any medication. 9. Surgical history of operation, laparoscopic interference, treatment of hirsutism by Laser.

General examinations were carried out involving evaluation of vital signs (HR, RR, blood pressure, temperature…), and measurement of weight, and height (BMI). Also, Abdominal and local

clinical examination was done to detect fundal level and gestational age, scar of previous operation, mass, tenderness or rigidity, and any abdominal or pelvic clinically detectable pathology.

After that, a routine ultrasonography, and 4D ultrasonography examination were applied. Ultrasonography had been done in supine position. Ultrasound transducer was held along the maternal longitudinal axis and had been held perpendicular to the floor during measurement of amniotic fluid index. External pressure over maternal abdomen with transducer must be avoided. Uterus had been divided into four imaginary quadrants.

Measurement will be done in the pocket free of fetal limbs and umbilical cord. This involves measurement of the amniotic fluid index (AFI). Amniotic fluid index was calculated by summation of deepest pocket in each quadrant. The degree of poly hydramnios had been categorized as: mild (AFI: 20.1-30 cm), moderate (AFI: 30.1-35 cm), and severe (AFI>35 cm). Detailed anomaly scan had been done to look for congenital malformations using 4D ultrasonography. In addition, routine laboratory investigations were conducted.

Assessment of amniotic fluid, anomaly scan and we had been done antenatal care for them every 4 weeks as BP, blood sugars, weight, etc. At the last visit in the theater of labor we had been follow up the mother before delivery by part gram to follow up the events of labor and CTG during the labor to do assessment of fetal viability. After the delivery vaginal or CS we had been follow up the neonate throw the first 48 hrs. Apgar score was used to study the effect of polyhydramnios on fetal outcome in form of fetal distress, growth retardation, and NICU admission.

Assessment parameters included: Primary outcome; the etiological factors of polyhydramnios as a diagnostic study in Minia governorate, and Secondary outcome such as: 1) Detestation the

relationship between polyhydramnios and fetal macrosomia and IUGR. 2) To detect the relationship between polyhydramnios and fetal gender. 3) To detect the relationship between polyhydramnios and congenital anomalies and which type is common in our country. 4) To detect the rate of unexplained polyhydramnios in our country and its recurrence.

Ethical considerations

The ethical committee of Minia College of medicine approved the study. Study information sheet was provided for all participants before they signed written informed consent. The study was carried out in accordance with the guidelines of the Declaration of Helsinki. Objectives and methods and possible outcomes of study were explained to every participant to boost response rate. Confidentiality, anonymity, and withdrawal were assured.

Statistical analysis

Data was processed and analyzed using the Statistical Package for Social Sciences (IBM-SPSS/PC/VER 24)*.

Continuous data was expressed as mean, standard deviation (SD), median, range and qualitative data was reported as frequencies and percentage.

Results

The main aim of this study was to detect the etiological factors of polyhydramnios in Minia governorate within limited tools. This prospective study was conducted in department of Obstetrics & Gynecology in Minia University. A group of 100 pregnant ladies irrespective of gestational age with amniotic fluid index more than 20cm was included in the study.

In the current study a total sample of 100 pregnant women with polyhydramnios were included. The mean age was 27.7± 5.3 years. There were 38% aged from 20 to 24 years, as observed in Figure (1). There were 86% with multigravida while 60% multipara among the participants. There were 38% with previous abortion while there were 48% with previous caesarian section among our participants, as demonstrated in Figure (2).

According to Table (1), the mean of systolic blood pressure was 137 ± 17. The mean of diastolic blood pressure was 87 ±6.1 and the mean of pulse 95 ±12. The mean of temperature was 37.5 ± 0.2. The mean BMI was 32.1± 5.7 among the participants. Regarding the maternal health condition among the participants, our results showed that the mean RBS was 214± 58 among the participants. The mean HbA1C was 7.0± 0.8 among the participants. There were 65% had gestational DM, 5% had preeclampsia, 6% had Rh negative and 7% had TORCH infection, as shown in Figure (3).

Concerning the AFI and turbidity among the participants, our results showed that the mean AFI was 30.3± 6.1 among the participants. There were 46% had mild polyhydramnios, 28% had moderate polyhydramnios and 26% had severe polyhydramnios, as illustrated in Figure (4). There were 14% had turbid amniotic fluid among the participants. In regard to fetal presentation, there were 58% cephalic, 32% breech and 10% other presentations. There were 10% with intrauterine growth retardation. The mean gestational age was 37.6± 1.2 weeks. There were 8% with congenital anomalies. The mean estimated weight by US was 3070± 607 g, as described in Table (2).

In regard to the Feto-maternal outcome among the participants, the current study showed that there were 14% had preterm delivery among the participants. Among the participants 48% had vaginal delivery and 52% had CS, as observed in Table (3). The mean weight at delivery was 3227.4± 639.5 g. Regarding fetal gender, there were 55% males and 45% females. Among our participants there were 23-% had 1-min APGAR score lower than 7 and 14% had 5-min APGAR score lower than 7. There were 14% admitted to NICU, among them 6% admitted for less than 24 hours, 5% admitted for 24 to 48 hours and 3% admitted for more than 48 hours. There were 7% had respiratory distress syndrome and 5% died.

There was an increase in the magnitude of the AOR for cesarean delivery as severity of polyhydramnios increased, but not for postpartum hemorrhage. There was no difference in the risks for PPROM, GHTN or preeclampsia, umbilical cord prolapses, or placental abruption between the normal fluid and polyhydramnios groups. Neonatal outcomes compared across study groups showed that Idiopathic polyhydramnios is associated with an increase in adverse outcomes, including nearly a fourfold increase in our primary outcome of NICU admission as well as a threefold to fourfold increase for macrosomia, and low 5-minute Apgar score. There was no increase in preterm birth or stillbirth rates within the polyhydramnios group when compared with the normal fluid group. There were no statistically significant differences in meconium-stained amniotic fluid, and postpartum hemorrhage.

Concerning the neonatal outcomes compared between studies groups in Idiopathic polyhydramnios at term were at an increasing risk of adverse neonatal outcomes, as shown in Table (4). Compared to term pregnancies with normal amniotic fluid, pregnancies with idiopathic polyhydramnios were at over 24-fold higher risk of IUFD. Risk for IUFD was extraordinarily increased in idiopathic polyhydramnios group with an AFI greater than 30 cm. These cases also had a higher risk for macrosomia and low Apgar scores at 5 min. Neonatal death and NICU admission failed to present statistical difference in this study.

Discussion

The amniotic fluid is the protective liquid present in the amniotic sac, and mainly composed of water and solids. It serves as a protective cushion for the growing fetus, has antibacterial properties to protect the growing fetus from infection, also it facilitates the exchange of nutrients, water and biochemical products between mother and fetus [9]. However, in certain cases Amniotic fluid index (AFI) of the amniotic fluid volume

is greater than 20 cm, the phenomenon is referred as polyhydramnios [10]. The degree of increase in the AFV is directly associated with the increase in adverse risk factors on mother and fetus prenatally [10, 11]. Amniotic fluid volume reflects the state of pregnancy and possible adverse complications and outcome, due to which assessment of AFV has been part of every second and third trimester ultrasound examination. Both SDP and AFI are good indicators for normal AFV [9].

The present work was supported by Suleiman & Salim [12], who performed a retrospective matched case control study was conducted to examine the incidence of caesarean delivery (CD) among women admitted with polyhydramnios with and without a trial of labour compared to women with normal AFI. The study enrolled 294 cases with polyhydramnios with mean maternal age 30.7 ± 5.7 years, mean parity 2.8 ± 1.5 and 21% Nulliparity.

In the current study we found that the mean of systolic blood pressure was 137 ± 17. The mean of diastolic blood pressure was 87 ±6.1. The mean of pulse 95±12, the mean of temperature was 37.5 ± 0.2, the mean BMI was 32.1± 5.7 among the participants. Regarding the maternal health condition among the participants, our results showed that the mean RBS was 214± 58 among the participants. The mean HbA1C was 7.0± 0.8 among the participants. There were 65% had gestational DM, 5% had preeclampsia, 6% had Rh negative and 7% had TORCH infection. However, the study by Suleiman & Salim [12] reported that among the polyhydramnios group there were Gestational diabetes was in 35 (11.9%) cases, pre-gestational diabetes 2 (0.7%) cases, any diabetes in pregnancy 37 (12.6%) cases, and maternal diseases found in 16 (5.4%) cases. there were 4.8% of the cases had hypertensive disorders.

And the study by Wiegand et al. [13] reported that there were 11.4% of the

polyhydramnios cases had chronic hypertension. Furthermore, the study by Bakhsh et al. [9] noticed that in the polyhydramnios cases there were Hypertension in 1 (7.1%), Diabetes mellitus in 2 (14.3%) Bronchial asthma in 1 (7.1%), Gestational Diabetes mellitus in 4 (28.6%) Hypothyroidism in 1 (7.1%) and Anemia 1 (7.1%), and the study reported that Diabetes mellitus and gestational diabetes are the most important maternal risk factors that can cause amniotic fluid disorders which support our results of high incidence of DM among the studied group.

Regarding the AFI and turbidity among the participants, our results showed that the mean AFI was 30.3± 6.1 among the participants. There were 46% had mild polyhydramnios, 28% had moderate polyhydramnios and 26% had severe polyhydramnios. There were 14% had turbid amniotic fluid among the participants. The study by Wiegand et al., [13] observed that there were 10,536 pregnancies: 10,188 with a normal AFI,

274 mild (78.74%), and 74 moderate–severe polyhydramnios (21.26%). The mean AFI of the polyhydramnios group was 28.34 ± 4.66 cm. However, the study by Luo et al. [5] described that in the 307-polyhydramnios group the mean AFI was 27.0 ± 3.38 cm, there was 276 mild cases (89.9%), 23 moderate cases (7.4%) and 8 severe cases (2.6%).

Regarding fetal presentation, there were 58% cephalic, 32% breech and 10% other presentations. There were 10% with intrauterine growth retardation. The mean gestational age was 37.6± 1.2 weeks. There were 8% with congenital anomalies. The mean estimated weight by US was 3070± 607 g. Polyhydramnios may be isolated or idiopathic or may be a sign of underlying maternal complications or foetal congenital anomalies [14]. However, the study by Suleiman & Salim [12] demonstrated that there were abnormal presentation present in 27 (9.2%) of them Transverse lie were 7 (2.4), Breech presentation 8 (2.7), Face presentation 3 (1.0) and Persistent

Occiput Posterior 9 (3.1). Gestational age at delivery in weeks was 38.8 ± 2.0. Concerning the Neonatal birth weight, the majority 239 (81.4%) had weights from 2.5-4.0 kg with mean 3440.7 ± 549.3 g. There were no significant differences between the groups in the incidence of placental abruption, pathological foetal presentation, obstetric anal sphincter tears, or blood transfusion due to postpartum haemorrhage.

Regarding the Feto-maternal outcome among the participants, the current study showed that there were 14% had preterm delivery among the participants. Among the participants 48% had vaginal delivery and 52% had CS. The mean weight at delivery was 3227.4± 639.5 g. Regarding fetal gender, there were 55% males and 45% females. Among our participants there were 23% had 1-min APGAR score lower than 7 and 14% had 5-min APGAR score lower than 7. There were 14% admitted to NICU, among them 6% admitted for less than 24 hours, 5% admitted for 24 to 48 hours and 3% admitted for more than 48 hours. There were 7% had respiratory distress syndrome and 5% died.

However, the study by Suleiman & Salim [12] declared that there were 28 (9.5%) had Delivery <37 weeks. Regarding delivery mode, Vaginal were in 202 (68.7%) and Caesarean in 92 (31.3%). Neonatal birth weight was 3440.7 ± 549.3g, and male gender were 159 (54.3%). Apgar score at 5 min <7 was in1 (0.3%) and no reported fetal death. They also reported that the incidence of overall caesarean delivery was significantly higher among women with polyhydramnios (31.3%) compared to the controls (18.7%) (p < .001; OR 2.0; 95%CI 1.35–2.90). Mean neonatal birth weight was significantly higher among infants born to women from the study group compared to the control group. Additionally, among the study group 41 (13.95%) neonates compared to 18 (6.12%) neonates in the control group weighed more than 4.0 kg (p ¼ .002; OR 2.49; 95%CI 1.39–4.38) even after

excluding women with diabetes in pregnancy. Apgar score less than 7 at 5 minutes did not differ between the groups. The incidence of cord artery pH less than 7.1 was higher among neonates in the study group compared to the controls.

Conclusions

Women with polyhydramnios had an increased risk for delivery by a caesarean section. Both the diabetes mellitus and gestational diabetes are the main risk factors of polyhydramnios. Regarding the maternal and fetal outcomes, the results indicated that polyhydramnios associated with gestational age at late term and neonatal birth weighted > 2.5 Kg and NICU admission. The polyhydramnios severity was not significantly correlated with outcome including IUGR, preterm delivery, mode of delivery, weight at delivery, APGAR score, NICU admission, RDS and neonatal delivery.

Author's contributions

All authors participated the study design, performed the experiments, collected and analyzed the data, drafted the manuscript, and confirmed the authenticity of all the raw data. All authors read approved the final draft of the manuscript.

Conflict of interest

The authors have no conflict of interests to declare.

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Table (1): Vital signs among the participants

Variable	Mean ± SD (Range)
Systolic blood pressure, mmhg	$137 \pm 17 \ (120 - 200)$
Diastolic blood pressure, mmhg	$87 \pm 6.1 \ (80 - 110)$
Pulse, bpm	$95 \pm 12 \ (80 - 140)$
Temperature, degrees	$37.5 \pm 0.2 \ (36.5 - 38)$
BMI, kg/m^2	$32.1 \pm 5.7 \ (20 - 40)$

Table (2): Fetal characters among the participants

Variable		No (%)
Fetal presentation	Cephalic	58 (58)
	Breech	32 (32)
	Other	10 (10)
IUGR, n (%)		10 (10)
Congenital anomalies, n (%)		8 (8)
Estimated fetal weight (mean±SD (Range))		$3070 \pm 607 \ (1571 - 4000)$
Gestational age (mean±SD (Range))		$37.6 \pm 1.2 \ (34 - 39)$

Table (3): Feto-maternal outcome among the participants

Variable		No (%)
Preterm delivery, n (%)		14 (14)
Mode of delivery	Vaginal	48 (48)
	CS	52 (52)
Weight at delivery, mean± SD		3227.4± 639.5
Gender	Male	55 (55)
	Female	45 (45)
1-min APGAR<7		23 (23)
5-min APGAR<7		14 (14)
NICU, n (%)		14 (14)
NICU duration	<24 hours	6 (6)
	24-48 hours	5 (5)
	> 48 hours	3 (3)
RDS, n (%)		7 (7)
Neonatal mortality, n (%)		5 (5)

RDS; Respiratory distress syndrome

Table (4): Comparison between the three degrees of polyhydramnios regarding feto-maternal outcome

Variable		Mild (n = 46)	Moderate (n = 28)	Severe (n = 26)	P-value
IUGR		3 (6.5)	6 (21.4)	1 (3.8)	0.056
Preterm delivery. N (%)		9 (19.6)	1 (3.6)	4 (15.4)	0.153
Mode of delivery	Vaginal	21 (45.7)	15 (53.6)	14 (53.8)	0.785
	CS	25 (54.3)	13 (46.4)	12 (46.2)	
Weight at delivery, mean± SD		3202 ± 640	3307 ± 573	3185 ± 717	0.739
1-min APGAR<7		12 (26.1)	8 (28.6)	3 (11.5)	0.264
5-min APGAR<7		8 (17.4)	6 (21.4)	3 (11.5)	0.624
NICU, n (%)		10 (21.7)	5 (17.9)	5 (19.2)	0.915
NICU duration	<24 hours	5 (10.9)	0 (0)	1 (3.8)	0.634
	24-48 hours	1 (2.2)	2 (7.1)	2 (3.8)	
	> 48 hours	0 (0)	1 (3.6)	2 (7.6)	
RDS, n (%)		5 (10.9)	1 (3.6)	1 (3.8)	0.375
Neonatal mortality, n (%)		1 (2.2)	2 (7.1)	2 (7.6)	0.553
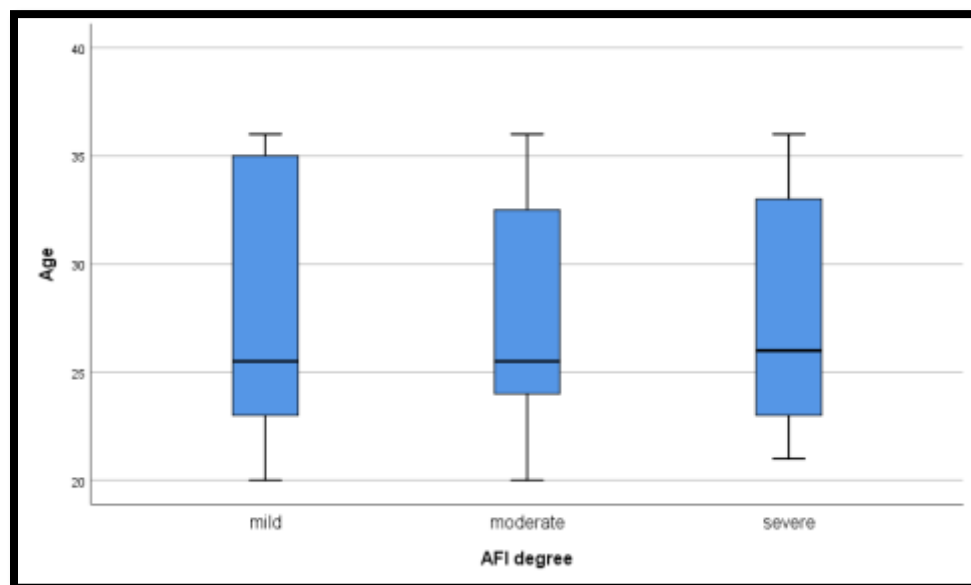
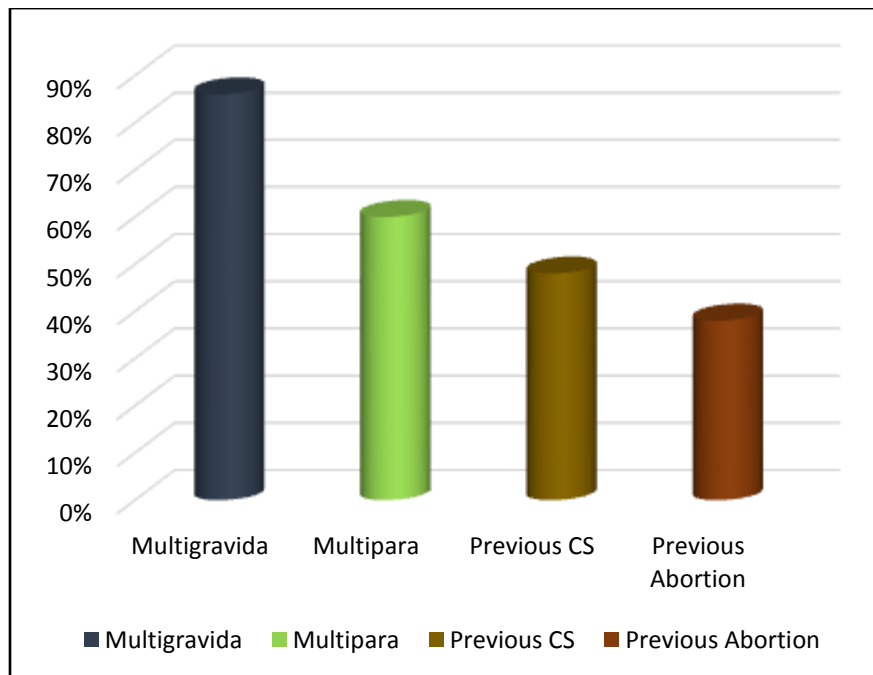**Fig. 1: Age among degrees of polyhydramnios**

Fig. 2: Parity, gravidity, previous CS and abortion among the participants
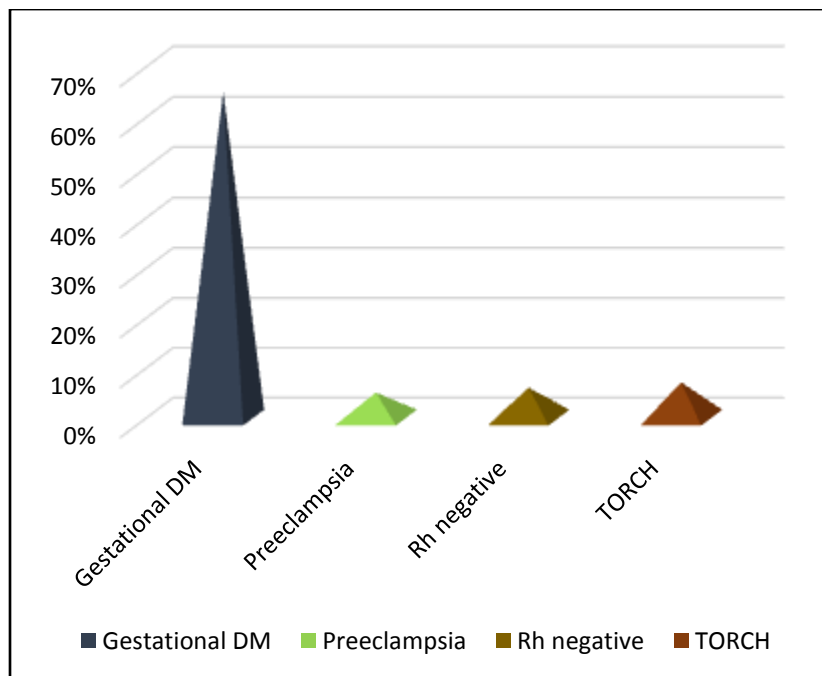

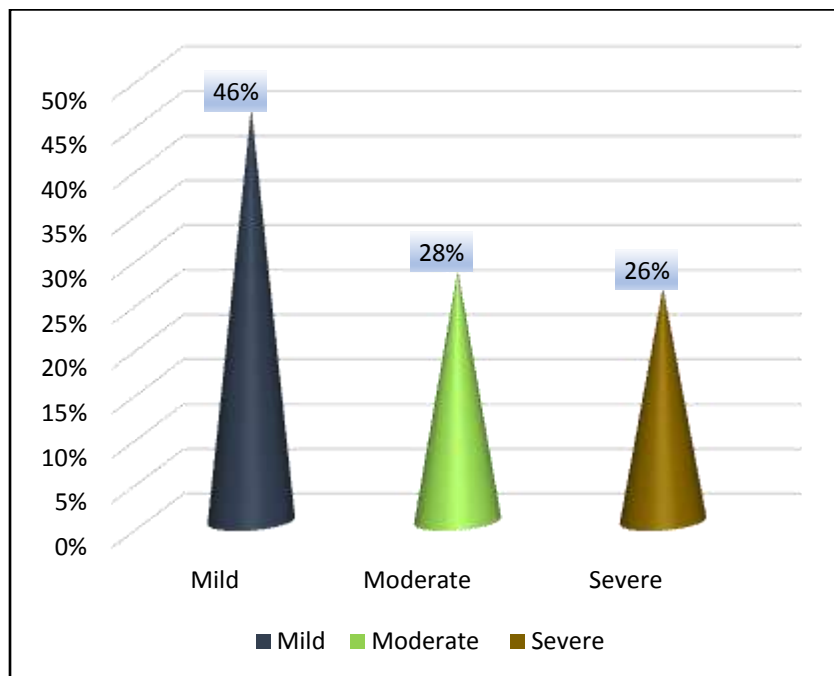**Fig. 3: Maternal health condition among the participants**

Fig. 4: Polyhydramnios degrees among the participants

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