



Abnormal AFI and Its Implications on Fetomaternal Outcome

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: The AFI is directly associated with adverse outcomes for both the mother and the foetus; oligohydramnios (AFI ≤ 8 cm) and polyhydramnios (AFI ≥ 25 cm) are considered 'abnormal'. The aim of this study was to compare the maternal and foetal complications in full-term pregnancies with abnormal AFI, as well as to assess the effectiveness of ultrasound and Doppler in identifying possible threats that may affect delivery plans.

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Methods: The current observational study was conducted in a hospital context at Paropakar Maternity and Women's Hospital located in Kathmandu, Nepal between October 2019 and February 2020. This study investigates the maternal and fetal outcomes associated with polyhydramnios and oligohydramnios in 60 cases of pregnancy. Data on maternal and foetal results, including the type of birth, problems, and neonatal APGAR ratings, were collected and evaluated. Continuous variables were described as mean \pm SD, while categorical data were expressed in percentage.

Results: The prevalence of polyhydramnios was 2% and oligohydramnios was 5.33%. Common maternal complications included preeclampsia, postpartum hemorrhage, and gestational hypertension, while fetal outcomes included low APGAR scores, low birth weight, and NICU admissions. Oligohydramnios was found to be predominantly associated with post-term pregnancies (36.36%) and preterm premature rupture of membranes (13.63%), which led to a higher frequency of caesarean sections (70.46%) when compared to polyhydramnios cases.

Conclusion: Our findings suggest that ultrasound and Doppler assessments are crucial in identifying high-risk pregnancies and making appropriate delivery decisions to improve maternal and fetal outcomes."

Keywords: Maternal; foetal outcomes; pregnancy; amniotic fluid; feto-maternal outcome.

1. INTRODUCTION

Amniotic fluid is the protective liquid in amniotic sac of pregnant uterus. It develops as fluid-filled extracelomic cavity before embryo is recognized (Underwood et al., 2005). In first trimester, human amniotic fluid is isotonic with maternal or foetal plasma and contains minimal protein (Campbell et al., 1992). Amniotic fluid provides protection to the foetus from traumatic forces, cord compression and microbial pathogens. AF has an integral role in the development of foetal musculoskeletal, pulmonary and gastrointestinal systems (Hill et al., 2003). Normal amniotic fluid volume at 10 weeks of gestation is 30 ml, at 16 weeks is 200 ml. AFV increases to a maximum of 400-1200ml at 34-38 weeks. After 38 weeks, fluid volume declines by approximately 125ml/week, an average volume of 800ml at 40 weeks (Cunningham, 2005).

The most common method of calculating an AFI is by using semi-quantitative method by ultrasound that measures the sum of the deepest pockets of amniotic fluid in the 4 quadrants of maternal abdomen (American College of Obstetricians and Gynecologists, 1999). The normal amount of AFI when measuring the large single vertical pocket (SVP) ranges from 2 to 8cm. If AFI \geq 8 cm it is called polyhydramnios and when it is \leq 2cm called oligohydramnios (Cunningham, 2005). Polyhydramnios occurs in 0.4%-1.2% of pregnancies and it is associated with a high perinatal mortality rate due to fetal malformations and immaturity; it is also associated with diabetes and possibly with preeclampsia (Thompson et al., 1998). The various maternal complication associated with polyhydramnios in mother were pre-eclampsia,

antepartum hemorrhage, gestational diabetes, abruptio placenta, anemia, Intrauterine infection, acute renal failure (Thompson et al., 1998). The fetal complications associated with polyhydramnios is preterm delivery. Oligohydramnios is associated with congenital heart anomalies, chromosomal aneuploidy, foetal demise, ruptured membranes, abnormal FHR, fetal distress, facial distortion and clubfoot, pulmonary hypoplasia IUGR and fetal asphyxia which often require LSCS and may result in perinatal morbidity and mortality (Bromley et al., 1991; Bronshtein & Blumenfeld, 1991; Gupta et al., 2012). Doppler waveforms of umbilical artery is an indirect measure of insufficient uteroplacental function (Divon & Ferber, 2001). Umbilical artery doppler (UAD) has an important role in modern obstetric assessment in high risk pregnancies (McDonnell et al., 1994).

In regular practice at our centre, amniotic fluid index (AFI) is measured with ultrasonography at 8 weeks, 20 weeks, and full-term gestation. Cases with severe AFI levels (AFI $<$ 4 cm or AFI $>$ 40 cm) were managed with heightened caution, and labor trials were avoided due to the elevated risk of adverse perinatal outcomes. Cases with altered AFI are further assessed using Doppler USG for more accurate evaluation and management. However, as of now, abnormal AFI findings at term are not commonly reported in routinely. The aim of this study is to evaluate the outcomes of full-term pregnancies with abnormal AFI and to determine how this finding can help to decide the timing of delivery. The study seeks to assess the potential of ultrasound and Doppler ultrasound in identifying mothers and fetuses at greater risk of adverse perinatal outcomes associated with abnormal amniotic fluid levels.

By detecting these risks, obstetricians can make timely, evidence-based decisions to improve foetal and maternal outcome.

2. METHODS

2.1 Study Design and Setting

This exploratory research, conducted in a hospital context, took place in Paropakar Maternity and Women's Hospital (PMWH) in Kathmandu and was conducted from October 2019 to February 2020.

2.2 Study Population and Sampling

The study recruited term pregnancies that met specific criteria for inclusion in the study, using convenience sampling. The participants were selected from the antenatal clinic outpatient, the emergency, and inpatient sections. Among the 1500 admissions per month, 110 cases of abnormal amniotic fluid volume were identified, of which 30 were polyhydramnios and 80 were oligohydramnios. Using a prevalence rate of 4%, the required sample size was determined to be 60, adhering to a ratio of 5:1 for cases with oligohydramnios to polyhydramnios.

2.3 Inclusion and Exclusion Criteria

Inclusion Criteria: The study will include singleton term pregnancies with AFI less than or equal to 8cm (oligohydramnios) or greater than or equal to 25cm (polyhydramnios) by ultrasound assessment.

Exclusion Criteria: Cases of IUD and normal AFI, which falls between 8 and 25 centimetres will not be included in the study.

2.4 Data Collection

After obtaining the approval from the Institutional Review committee (IRV), participants who fulfilled the inclusion criteria and were at least 37 weeks' gestation underwent AFI and foetal wellbeing assessment by ultrasound and Doppler ultrasound when needed. Demographic characteristics, past medical history, general physical examination, and necessary relevant investigations were noted on a structured form. The data collected included patients' demographic data, obstetric history, medical, surgical, and family history of chronic diseases. Maternal and foetal status were closely

monitored to determine the subsequent care including follow up, induction of labour or caesarean section. The APGAR scores were done at 1 and 5 minutes after birth, complications of the mother and foetus were also recorded.

2.5 Amniotic Fluid Index Measurement

AFI measurements were performed by experienced radiologists using a Samsung H60 ultrasound machine coupled with a 5-7 MHz transducer. The uterus was divided into four quadrants and the maximum depth of the fluid collection in each quadrant was measured and the values added together. AFI of 5 cm or less was considered as oligohydramnios, AFI between 5 and 8 cm was considered as borderline oligohydramnios and AFI of 25 cm or more was considered as polyhydramnios.

2.6 Data Analysis

Data analysis was done using SPSS version 16. The continuous variables were described by mean \pm standard deviation (SD) and categorical variables were presented by frequency and percentage. Finally, the level of significance was set at $p < 0.05$ and the data analysed by Pearson correlation coefficients.

3. RESULTS

Out of the total 60 cases of abnormal amniotic fluid index, 16 cases of polyhydramnios and 44 cases of oligohydramnios were present. The maximum number of polyhydramnios cases 8 (50%) belonged to the age group between 20-24 years with mean age of 22 years. While in oligohydramnios group, 50% of patient were in the age group of 20-24 years with mean age of 22 years. The age ranged from 19 to 40 years. Among the polyhydramnios cases, about 69% were primigravida. Similarly, among oligohydramnios, 59.1% were primigravida as in Fig. 2.

The common maternal condition associated with oligohydramnios were post-dated pregnancy in 36.36%, PROM in 13.63% followed by PIH 6.81%. Anaemia was found to be associated as a co-morbid factor.

Among the 44 oligohydramnios cases, 3 cases were found to be associated with fetal abnormalities as in Table 2.

Table 1. Maternal factors associated with oligohydramnios

Factors	AFI (cm)		Total no.
	<5 cm	5–8 cm	
PIH	0	3	3 (6.81%)
PROM	1	5	6 (13.63%)
Chronic abruption	0	0	0
Postdated pregnancy (40–42 weeks)	1	15	16 (36.36%)
Post term pregnancy (>42 weeks)	0	0	0

Table 2. Fetal factors associated with oligohydramnios

Factors	AFI (cm)		Total no.
	<5 cm	5–8 cm	
GIT Abnormalities	0	1	1(2.27%)
CNS Abnormalities	1	0	1(2.27%)
CVS Abnormality	1	0	1(2.27%)
Congenital infections	0	0	0

Table 3. Maternal factors associated with polyhydramnios

Factors	AFI (cm)			Total no.
	25–30 cm	30–35 cm	>35 cm	
Diabetes mellitus	4	0	0	4 (25%)
PIH	2	0	0	2 (12.5)
RH Isoimmunization	0	0	0	0
Rh incompatibility	0	0	0	0
Cardiac abnormality	0	0	0	0

Table 4. Fetal factors associated with polyhydramnios

Factors	AFI (cm)			Total no.
	25–30 cm	30–35 cm	>35 cm	
CNS Defects	0	1	0	1 (6.25%)
GIT Abnormalities	0	0	0	0
Skeletal malformation	0	0	0	0
Fetal TUMOR	0	0	0	0
CVS Abnormality	0	0	0	0
Intrauterine infections	0	0	0	0

Among 16 cases of polyhydramnios, 6 cases were found to be associated with Maternal factors mentioned in the Table 3, 4 cases (25%) were of DM and 2 cases (12.5%) were of PIH.

Fetal factors causing polyhydramnios was found to be just 1 case (6.25%) with CNS defect among 16 cases of polyhydramnios.

Among 44 women diagnosed with oligohydramnios, 4 women (9.09%) had PIH, 1 woman (2.27%) had post-partum hemorrhage, anemia and UTI. Whereas in case of polyhydramnios, 2 cases (12.5%) have PPH followed by each 1(6.25%) case of GDM and

renal complication and maternal fever with dyspnea.

Among 44 women diagnosed with oligohydramnios, 6 (13.63%) newborn baby had low APGAR score (<5 at 1 minute, <7 at 5 minute). 5 (11.36%) newborn baby have <2.5kg weight and 6(13.63%) baby was admitted in NICU/SCBU followed by 1(2.27%) with congenital anomaly and NND. While in case of polyhydramnios among 16 cases, 2 newborn babies (12.5%) were admitted in NICU/SCBU, and 1(6.25%) case with congenital anomaly and low APGAR score (<5 at 1 minute and <7 at 5 minute).

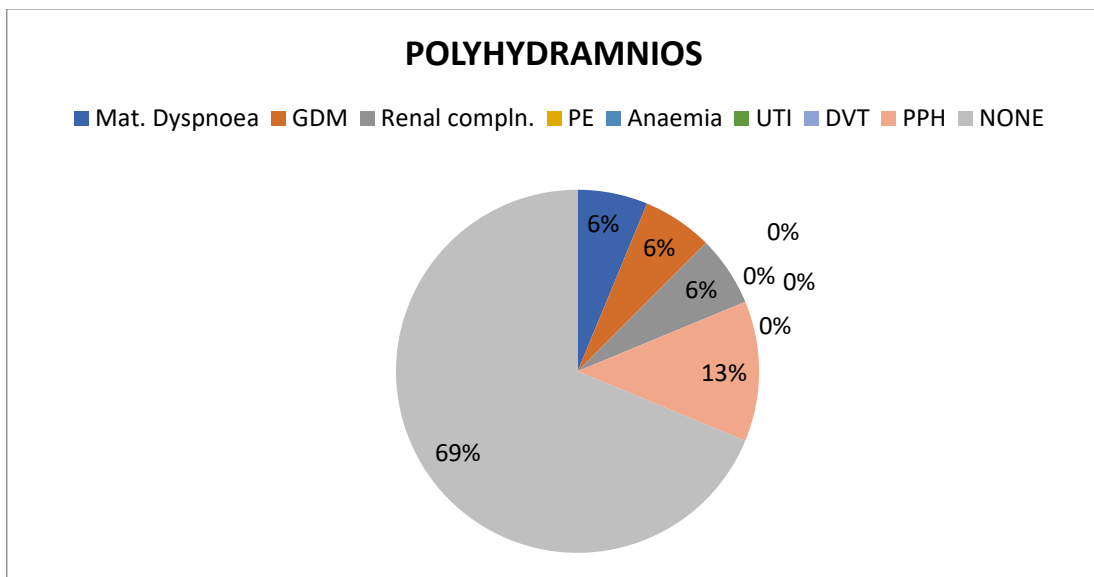
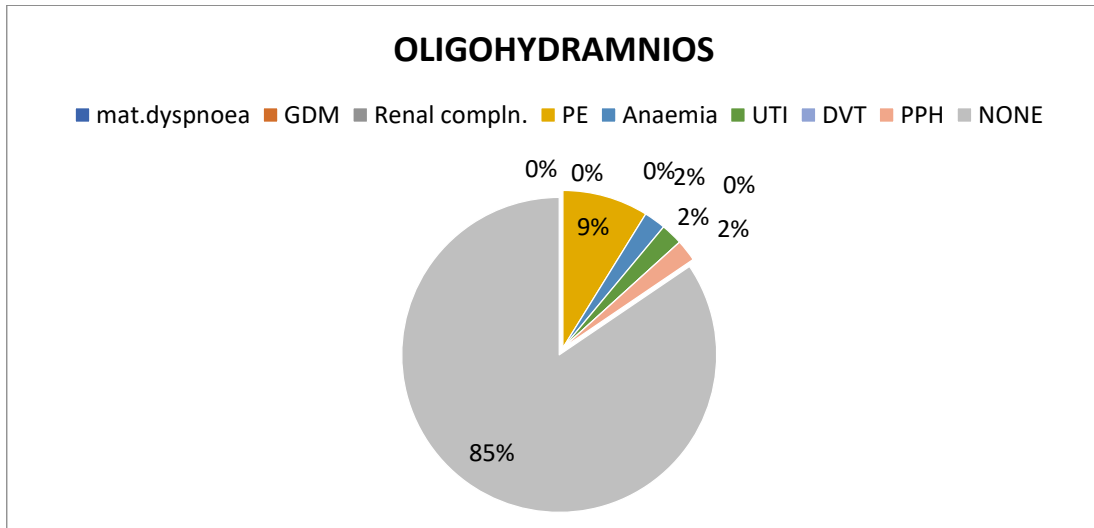
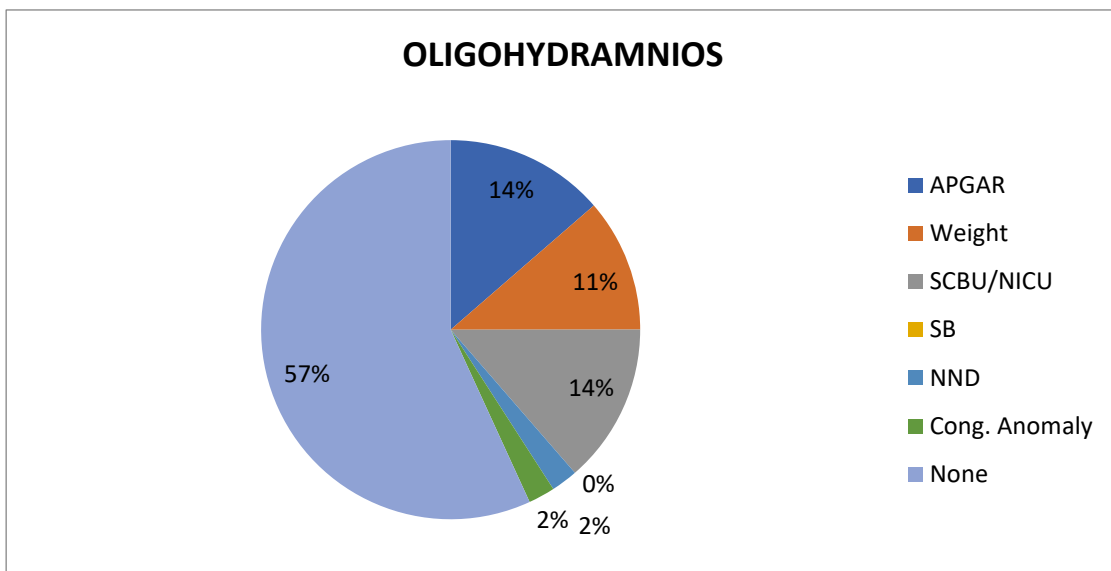


Fig. 1. Maternal outcome in oligohydramnios and polyhydramnios



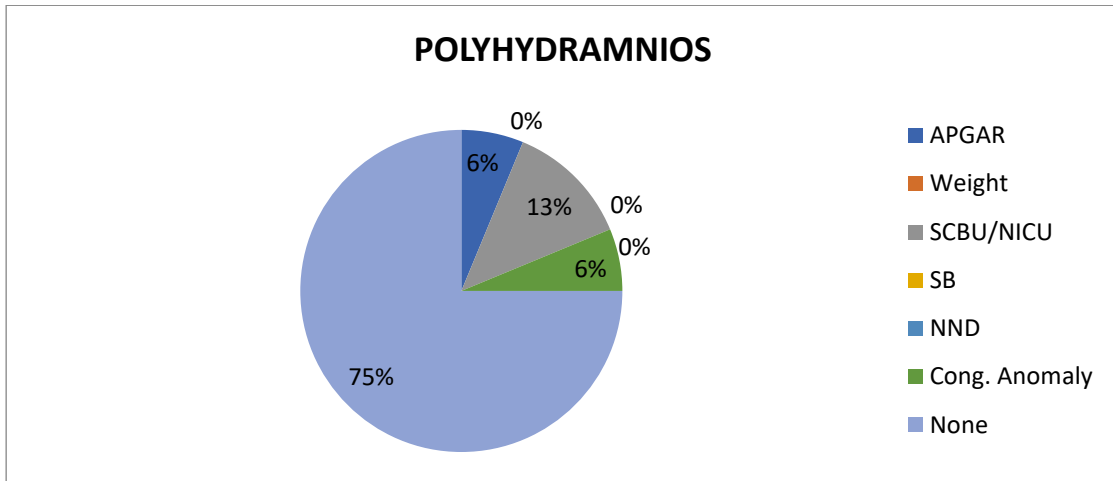


Fig. 2. Fetal Outcome in oligohydramnios and polyhydramnios

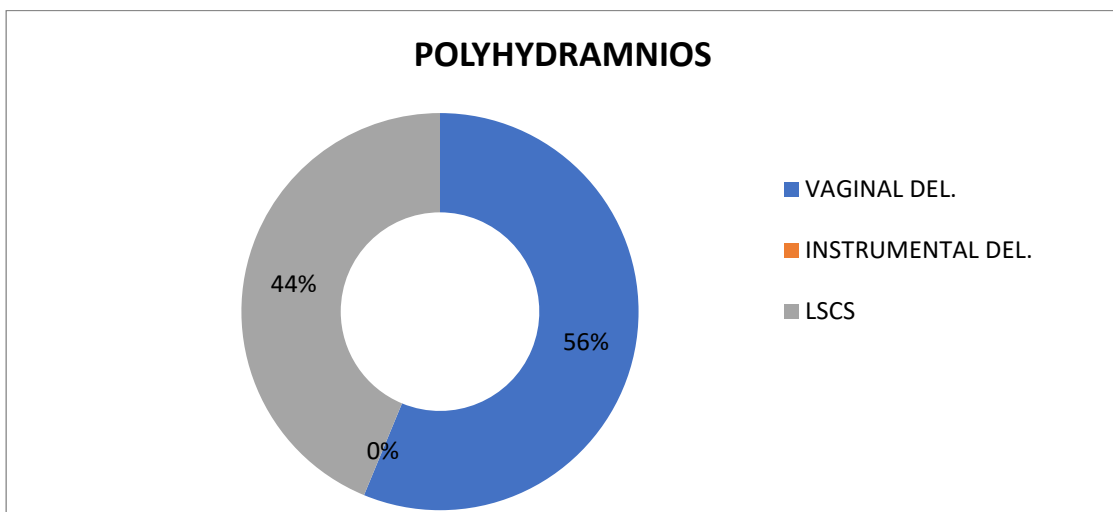
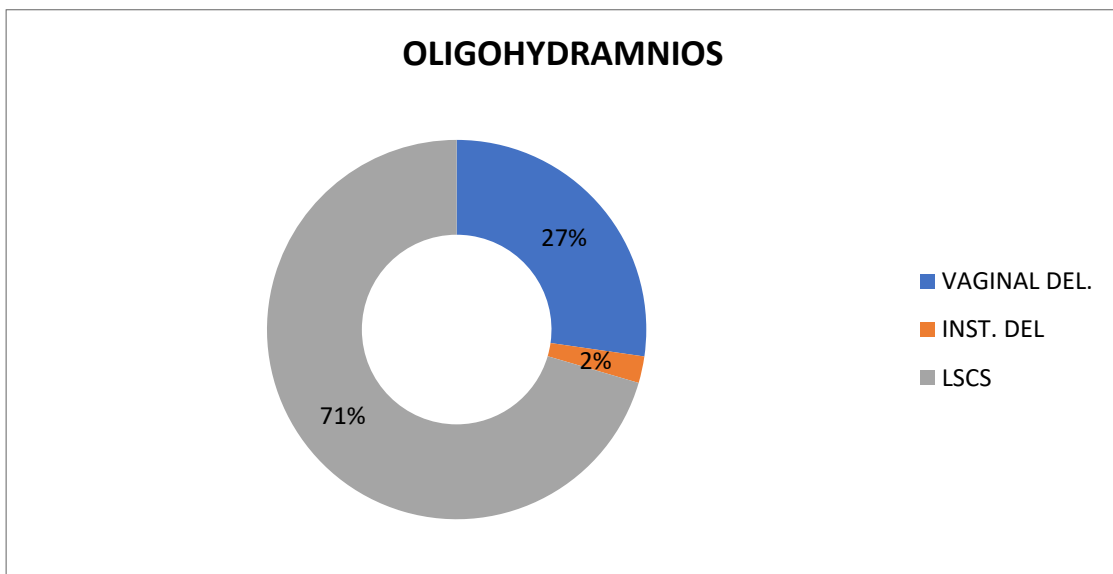


Fig. 3. Mode of delivery of the patient with abnormal AFI

In a total of 44 cases of oligohydramnios, 26 (70.46%) underwent LSCS, 12(27.27%) had vaginal delivery, and 1(2.27%) had instrumental delivery. Whereas in 16 cases of polyhydramnios, 9(56.25%) had vaginal delivery, 7(43.75%) had LSCS.

4. DISCUSSION

Polyhydramnios is relatively less common complication in pregnancy compared to oligohydramnios in clinical practice. In a total of 60 cases, 44 cases of oligohydramnios were present in our present study. In this study incidence of polyhydramnios was 2% and was comparable and similar to Bundgaard et al. (2007) while incidence was slightly low in Rajgire et al. (2017) with 1.5% case of polyhydramnios, and slightly higher in Pri-Paz et al. (2012), with incidence of polyhydramnios of 2.3%. Whittington et al. (2023) emphasize that the presence of polyhydramnios can be associated with adverse perinatal outcomes, reinforcing the significance of careful prenatal monitoring in cases involving this condition (2023).

Oligohydramnios is a relatively common complication in pregnancy and is usually encountered in clinical practice. Total 44 cases of oligohydramnios were present in the present study. In this study incidence of oligohydramnios was 5.35% and was comparable to Mishra (2007), with incidence of 0.5-5%. Shivalingaiah et al. (2015), Gaikwad et al. (2017) reported incidence of 3-7%, 3-8% which was slightly higher than the present study. Tajinder & Ruchika (2016), Goyal et al. (2014), reported incidence of 10%, 15%, respectively which were higher than the present study.

Most common maternal condition associated with oligohydramnios out of 44 cases, Post-dated pregnancy was 36.36%, PROM 13.63% followed by PIH 6.81% which is similar to Raghuwanshi & Aggarwal (2016) with post maturity >42 wog have highest percentage of oligohydramnios (35.7%), PE(10.7%), eclampsia(3.5%) and PROM(21%). Kechagias et al. (2024) highlight that idiopathic polyhydramnios, despite being of uncertain origin, can significantly impact obstetric and neonatal outcomes, emphasizing the need for continuous assessment in similar conditions. Maximum cases of oligohydramnios were most commonly observed in in post maturity followed by PIH and PROM. Similarly, a study done by Guin et al. (2011) most common maternal factors was post maturity with 38.5% followed by PROM

with 30%. While stude done by Raghuwanshi & Aggarwal (2016) about 50% case were of post maturity followed by PIH 30% and PROM 30% which were higher compared to our study. A case study done by Guin et al. (2011) had DM (20%) and (17%) of PIH which is almost similar to our study. Tajinder & Ruchika (2016) conducted the study in which diabetes mellitus (14.3%), PIH (14.3%), Rh incompatibility (14.3%).

In our study foetal risk factors in case of oligohydramnios each 1 cases of GIT, CNS, CVS abnormalities contributed to 2.27% with overall 7% of anomaly which was similar to Tajinder & Ruchika (2016) study in which in case of oligohydramnios group, renal anomalies (6.4%) and spina bifida 1.6% complication were seen with overall 8 % of abnormality. Tajinder & Ruchika (2016) in case of oligohydramnios group, renal anomalies (6.4%) and spina bifida 1.6% complication were seen. The variation in maternal and foetal risk factors have been reported in various studies in the pregnant women from observational studies in different countries. The varying result may be due to difference in geographical areas, lifestyle, literacy rate and socioeconomic status.

In our study Among 44 women diagnosed with oligohydramnios ,4 women (9.09%) had PE/PIH. 1 woman (2.27%) had post-partum hemorrhage, anemia and UTI. Whereas in case of polyhydramnios, 2 cases (12.5%) have PPH followed by each 1(6.25%) case of GDM and renal complication and maternal fever with dyspnea. A study done by Guin et al. (2011) found that diabetes was around 5% and PPH 20% in case of polyhydramnios. Another study done by Sonak & Talande (2019), the most common maternal complication associated with polyhydramnios was preterm labor (46%), followed by malpresentation (11%), atonic PPH (10%), PROM (9%), eclampsia (7%), abruptio placenta (6%) and dyspnea 4%, which was slightly more as compared to our study group. Whereas in case of oligohydramnios in a study done by Guin et al. (2011) shows about 21% of fetal congenital anomaly.

In case of fetal outcome, among 44 women diagnosed with oligohydramnios, 6 (13.63%) newborn baby had low APGAR score (<5 at 1 minute, <7 at 5 minute). 5 (11.36%) newborn baby have <2.5kg weight and 6(13.63%) baby was admitted in NICU/SCBU followed by 1(2.27%) with congenital anomaly and NND.

While in case of polyhydramnios among 16 cases, 2 newborn babies(12.5%) were admitted in NICU/SCBU, and 1(6.25%) case with congenital anomaly and low APGAR score (<5 at 1 minute and <7 at 5 minute) which is similar to our study done by Chate et al. (2016) in which Thick meconium(46%), low Apgar score at 5 min.(16%), birth weight <2.5 kg(12%), admission to NICU(4%), congenital anomalies & neonatal mortality(2%). Similarly, study done by Tajinder Ruchika (2016), Low APGAR score of < 7 at 1 minute was considerably high in both oligohydramnios and in polyhydramnios subjects. The incidence of IUD and macrosomia was significantly high in polyhydramnios group. Radhamani (2017) had APGAR of <7 at 5 minutes. 17.7% had birth weight of <2.5 kg and 6.9% of babies required which NICU admission.

In case of mode of delivery, in a total of 44 cases of oligohydramnios ,26(70.46%) underwent LSCS, 12(27.27%) had vaginal delivery, and 1(2.27%) had instrumental delivery. Whereas in 16 cases of polyhydramnios, 9(56.25%) had vaginal delivery, 7(43.75%) had LSCS which was similar to study done by Varghese et al. (2016) in which each group mode of delivery was as, In group 1 about 8% cases had labour induction, 16% delivered vaginally and 84% had LSCS. In group 2 about 24% had labour induction, 29% delivered vaginally and 71% had LSCS and in group 3, 50% had labour induction, 50% delivered vaginally and 50% had LSCS. In case of polyhydramnios study done by Sonak & Talande (2019) in which 62% cases of polyhydramnios delivered by cesarean section while 38% cases delivered vaginally. 57% control with normal fluid volume delivered vaginally while 43% had cesarean section in which case was similar to our study which is slightly higher than our study. Another case studied by Radhamani (2017), Tajinder & Ruchika (2016) in cases of isolated oligohydramnios 55.4%, 52.4% had vaginal delivery, 44.6% and 38.1% underwent LSCS While in case of polyhydramnios group caesarean section, instrumental delivery and normal delivery was 28.6 % which were low as compared to our study.

5. CONCLUSION

In this research study of 60 cases, the prevalence of polyhydramnios was noted to be 2% and oligohydramnios was noted to be 5.33%. Both conditions were more common in women in the age range of 20 to 24 years. Most of the cases were first time pregnant women. Oligohydramnios was most often observed in

post-term pregnancies, whereas polyhydramnios was most often connected with diabetes and hypertension that resulted from pregnancy. Maternal and neonatal adverse effects included preeclampsia, postpartum haemorrhage, low APGAR score, low birth weight and NICU admission. Ultrasound and Doppler assessments made at or after 37 weeks' gestation were useful in identifying high risk fetuses, therefore enabling appropriate delivery decisions to be made and improve maternal and foetal outcomes in pregnancies with abnormal levels of Amniotic Fluid.

ETHICAL APPROVAL AND CONSENT

The study was approved by the Institutional Review Board (IRB) of NAMS, Bir Hospital. All participants agreed in writing to participate in the research and were informed of anonymity and the right to refuse or withdraw from the study. Procedures followed were those of any standard hospital to ensure that the patients were safe during the study and the participants did not spend any more money than usual during the study.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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