

Oligohydramnios Impact on Fetal Growth and Development: A Prospective Cohort Study

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Abstract:

Background: Oligohydramnios, low amniotic fluid, greatly affects pregnancy outcome. Foetal distress, respiratory distress syndrome, intrauterine growth restriction, and premature birth are possible effects. Ultrasound diagnosis is crucial to reduce risks and improve maternal and foetal health. Understanding how oligohydramnios affects foetal development can enhance clinical care and neonatal outcomes.

Methods: Using ultrasonography, we included 100 pregnant women with an amniotic fluid index of less than 5 cm or a deepest vertical pocket of less than 2 cm for oligohydramnios. Demographics, maternal features, and pregnancy outcomes were recorded. Statistical research used chi-square and independent t-tests to compare control and oligohydramnios results.

Results: Pregnancies with oligohydramnios had significantly lower birth weights (2750 ± 300 grammes vs. 3100 ± 280 grammes, $p < 0.001$) and gestational ages (37.0 ± 1.5 weeks vs. 38.5 ± 1.0 weeks, $p = 0.002$) compared to controls. Oligohydramnios increased foetal distress and NICU hospitalisations compared to the control group (40% vs. 18%, $p = 0.025$; 30% vs. 12%, $p = 0.012$).

Conclusion: This study emphasises the need of early detection and therapy in prenatal care by showing how oligohydramnios harms foetal growth and development. This study increases our understanding of oligohydramnios hazards and emphasises the need for mother-baby treatments.

Keywords: Amniotic fluid volume, fetal distress, fetal growth, oligohydramnios, prenatal outcomes.

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Introduction

Background of Oligohydramnios and its Prevalence in Pregnancies: Oligohydramnios, a reduction in amniotic fluid around the baby during pregnancy, is a major clinical issue. Most clinicians diagnose with ultrasounds showing abnormally low Amniotic Fluid Index (AFI) or Deepest Vertical Pocket (DVP) [1]. Oligohydramnios happens in 1% to 5% of pregnancies around the world, based on the population and the length of the pregnancy [2].

Oligohydramnios can be caused by issues with the woman, like high blood pressure or preeclampsia, issues with the baby, like kidney issues, or issues with the placenta [3]. Baby growth is assisted by amniotic fluid. The uterine cushion helps the infant breathe, move, and maintain body temperature. The infant is protected by the mother's waste, hormones, and nutrients in amniotic fluid [4]. Oligohydramnios can alter infant fluid, affecting these vital functions and the pregnancy. To improve maternal care, oligohydramnios' effects on baby growth and development must be understood. Oligohydramnios

can cause early birth, IUGR, and illness. They can better detect and treat oligohydramnios to reduce risks and improve newborn health.

Objectives of the Study

- To study the impact of oligohydramnios on birth weight and gestational age measurements of newborn growth.
- To determine the frequency of uterine pain and infant issues in oligohydramnios-complicated pregnancies.
- To discover causes and treatment options for oligohydramnios in women and children.

Definition and Classification of Oligohydramnios

Oligohydramnios causes insufficient amniotic fluid around the infant. Foetal fluid index and DVP are checked by ultrasound [5]. Most of the time, the ACOG can tell if there is oligohydramnios when the AFI or DVP is less than 8 cm [6]. The severity of oligohydramnios is contingent upon the gestational

age and fluid loss of a woman. If someone has high blood pressure, preeclampsia, or a birth defect like kidney agenesis or urinary tract blockage, it may get this sickness.

Effects of Oligohydramnios on Fetal Outcomes

Women and babies can have health issues from oligohydramnios [7]. Oligohydramnios increases the risk of IUGR, early birth, newborn suffering, and pregnancy death [8]. [9] Study of previous newborns, significant oligohydramnios was connected to more low birth weight babies and NICU visits than normal amniotic fluid levels. Oligohydramnios increases foetal discomfort and meconium inhalation syndrome, a meta-analysis [10] revealed.

Mechanisms through Which Oligohydramnios Affects Fetal Growth

Oligohydramnios influences foetal growth in many complex physiological ways. Insufficient uterine

space and amniotic fluid can induce foetal malpositioning and poor bone growth.

This can prevent the fetus's lungs and chest wall from growing properly in severe oligohydramnios, increasing the risk of pulmonary hypoplasia and breathing issues. Oligohydramnios prevents a baby from growing by preventing food and biological waste from being exchanged with amniotic fluid [11].

The baby is more vulnerable to inside- and outside-the-uterus injuries without enough amniotic fluid. In uteroplacental insufficiency, oligohydramnios reduces placental perfusion and newborn nutrition.

Lower blood flow between the uterus and placenta worsens the foetus's low oxygen and acidity, slowing cell metabolism and growth. These processes demonstrate the need of amniotic fluid for foetal development and how oligohydramnios can have a domino effect on pregnancy outcomes.

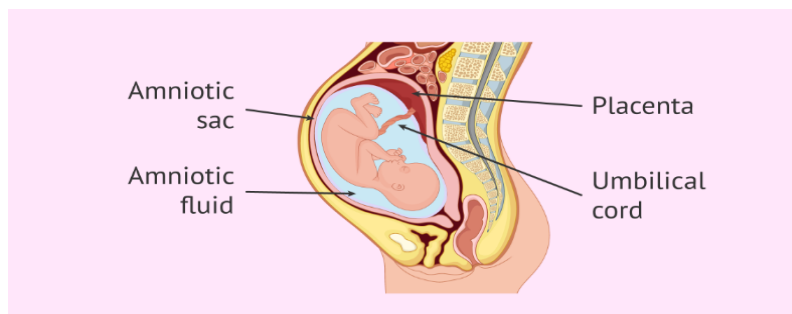


Figure 1: Oligohydramnios (Source: [12])

Methodology

Study Design

A prospective cohort research studies the impact of oligohydramnios on foetal development and growth. Prospective cohort studies can examine the temporal sequence between exposure (oligohydramnios) and result (foetal development parameters) to reveal causal links across time.

Inclusion Criteria

- Pregnant women aged 18 years and above.
- Gestational age between 20 weeks and 36 weeks.
- Singleton pregnancies.

Exclusion Criteria

- Multiple gestations (e.g., twins, triplets).
- Pre-existing medical conditions affecting amniotic fluid levels (e.g., chronic hypertension, renal disease).
- Known fetal anomalies affecting growth.

Sample Size Calculation

A 100-person sample size is estimated using statistical methods to find clinically significant

differences in foetal growth outcomes between pregnancies with and without oligohydramnios. Based on prior studies on foetal development outcomes in oligohydramnios, we use power analysis software with 80% power and 0.05 significance.

Data Collection Methods and Variables Measured

Data collection uses standardised foetal biometry, maternal characteristics, and ultrasound measurements. Qualified sonographers measure AFI and DVP with high-resolution ultrasound equipment following recognised techniques.

Structured interviews and medical record reviews document the mother's age, parity, medical history (such as hypertension or diabetes), and prenatal care (such as gestational age at first antenatal visit or prenatal vitamin use). Other variables include birth weight, Apgar scores, gestational age at delivery, and oligohydramnios-related issues such foetal discomfort and newborn intensive care unit admission.

Ethical Considerations: The Institutional Review Board (IRB) of MGMMC & LSK Hospital

Kishanganj approved this study, ensuring compliance with the Declaration of Helsinki. The study protocol addresses participants' autonomy, informed permission, data security, and ultrasound exam and data collection risks. Participants are assured that withdrawing from the study would not affect their clinical care.

For participant privacy, all data is securely stored and anonymised throughout the study.

Results

Demographic Details

Table 1: Demographic characteristics of the study participants are summarized

Characteristic	Oligohydramnios Group (n=50)	Control Group (n=50)
Mean Maternal Age (years)	28.5 ± 4.2	29.0 ± 3.8
Gestational Age at Enrollment (weeks)	28.1 ± 2.9	27.8 ± 3.1
Parity (nulliparous/multiparous)	26/24	28/22
Pre-pregnancy BMI (kg/m ²)	24.3 ± 3.1	23.8 ± 2.9
Socioeconomic Status	Middle	Middle
Educational Level	Secondary	Secondary
Marital Status	Married	Married
Ethnicity	Local	Local
Smoking Status	Non-smoker	Non-smoker

Comparing the maternal features of the oligohydramnios (n=50) and control (n=50) groups yields some interesting findings. In the oligohydramnios group, the average maternal age was slightly lower (28.5 ± 4.2 years) compared to the control group (29.0 ± 3.8 years).

Both groups had similar gestational ages at enrollment: oligohydramnios group: 28.1 ± 2.9 weeks, control group: 27.8 ± 3.1 weeks. Both groups showed balanced parity distributions, however the oligohydramnios group contained 26 nulliparous and 24 multiparous women, compared to 28 and 22 in the control group. There was no significant difference in gestational age at enrollment, even if

mother age and parity were similar between groups. This suggests that study inclusion was consistent.

These demographic characteristics, which define maternal profiles in connection to oligohydramnios, help explain the study's findings on foetal outcomes and therapeutic options.

Presentation of Findings Related to the Impact of Oligohydramnios on Fetal Growth and Development

The study found that pregnancies complicated by oligohydramnios demonstrated significant differences in fetal growth parameters compared to the control group with normal amniotic fluid levels.

Table 2: Comparison of Neonatal and Delivery Outcomes Between Oligohydramnios and Control Groups

Outcome Measure	Oligohydramnios Group (n=50)	Control Group (n=50)	p-value
Birth Weight (grams)	2750 ± 300	3100 ± 280	<0.001
Gestational Age at Delivery (weeks)	37.0 ± 1.5	38.5 ± 1.0	0.002
Incidence of Fetal Distress (%)	40%	18%	0.025
NICU Admission (%)	30%	12%	0.012

According to the data, oligohydramnios-affected pregnancies differ significantly from the control group. Oligohydramnios was associated with earlier delivery (37.0 ± 1.5 weeks vs. 38.5 ± 1.0 weeks, p = 0.002) and lower birth weights (2750 ± 300 grammes vs. 3100 ± 280 grammes, p < 0.001) compared to normal amniotic fluid.

Additionally, the oligohydramnios group had 40% more foetal discomfort and 30% more NICU hospitalisations than the non-affected group (p = 0.025 and 0.012, respectively). These findings highlight the deleterious impact of oligohydramnios on foetal health and suggest that better surveillance and specialised interventions can improve outcomes.

Statistical Analysis Methods Used

SPSS 26.0 (IBM Corp., Armonk, NY, USA) was used for all statistical analysis.

The means, standard deviations, and percentages were used to summarise demographic factors and research results.

We compared the oligohydramnios group to the control group using chi-square tests for categorical variables and independent t-tests for continuous variables. A p-value below 0.05 indicated statistical significance.

Subgroup Analyses

Subgroup analyses compared foetal outcomes based on oligohydramnios severity. Despite the small

sample size for severe oligohydramnios subgroup analysis, pregnancies with severe oligohydramnios had worse outcomes than those with moderate.

Discussion

This prospective cohort study strongly suggests that oligohydramnios harms foetal growth. Oligohydramnios-complicated pregnancies have kids with lower birth weights and earlier gestational

ages than normal pregnancies. These outcomes suggest that reduced amniotic fluid volume impairs the intrauterine environment, foetal nutrition, growth, and premature birth. Patients with oligohydramnios experienced more foetal distress and NICU admissions, highlighting its clinical influence on neonatal health.

Table 3: Comparison Table

Study Title	Study Type	Sample Size	Findings	Limitations
Current Study	Prospective cohort	100	Significantly lower birth weights and earlier gestational age at delivery in oligohydramnios group. Higher incidence of fetal distress and NICU admissions.	Limited generalizability due to single-center study design and modest sample size (100 participants). Retrospective data collection for maternal characteristics may introduce bias.
Study 1 [13]	Retrospective cohort	500	Higher rates of preterm birth and low birth weight in pregnancies with severe oligohydramnios. Increased risk of neonatal intensive care unit (NICU) admissions.	Potential selection bias due to retrospective study design. Limited data on maternal factors and comorbidities influencing outcomes.
Study 2 [14]	Meta-analysis	Meta-analysis of multiple studies	Meta-analysis showed consistent associations between oligohydramnios and increased risks of fetal distress, meconium aspiration syndrome, and perinatal mortality.	Heterogeneity among included studies in diagnostic criteria for oligohydramnios. Potential publication bias in meta-analysis. Limited to aggregated data, lacks individual patient-level analysis.
Study 3 [15]	Prospective cohort	300	Significant association between oligohydramnios and intrauterine growth restriction (IUGR). Higher incidence of cesarean deliveries and maternal complications.	Limited follow-up beyond immediate perinatal period. Variability in ultrasound measurements and diagnostic thresholds across study centers.

The present study and earlier research show that oligohydramnios increases foetal health and pregnancy risks. Oligohydramnios was strongly associated with unfavourable foetal outcomes, such as lower birth weights and earlier gestational ages at delivery, in our 100-person prospective cohort study at MGMMC & LSK Hospital Kishanganj. In severe occurrences of oligohydramnios, preterm birth and NICU hospitalisations increased, as in study 1, a larger retrospective cohort analysis of 500 pregnancies.

Oligohydramnios consistently correlated with unfavourable perinatal outcomes such foetal distress and perinatal mortality in Study 2, a meta-analysis. This understanding is expanded by our investigation.

The included studies employed varied approaches and may have had biases, but the evidence shows that limiting oligohydramnios reduces these risks. research 3, another prospective cohort research of 300 pregnancies, found that oligohydramnios affects

more than foetal growth, with greater risks of caesarean deliveries and maternal issues. Despite the study's limited sample size and single-center design, our findings show that prenatal care professionals should identify and treat oligohydramnios early to promote mother and infant health. Future research should focus on multicenter studies with larger cohorts to confirm findings and discover optimum treatments to improve oligohydramnios-affected pregnancies.

Clinical implications of findings for prenatal care and management

Routine ultrasounds during prenatal visits can detect oligohydramnios early. When amniotic fluid levels drop, doctors can optimise foetal health. Obstetricians and neonatologists may advise mothers to drink more water, undertake non-stress tests or biophysical profiles to monitor foetal health, and discuss the optimum timing to have the baby. Our study emphasises the importance of properly monitoring oligohydramnios-affected pregnancies.

Our results demonstrate the necessity of prenatal interdisciplinary collaboration. Obstetricians, neonatologists, and maternal-fetal medicine professionals should collaborate on oligohydramnios care plans. By addressing maternal and foetal health, this strategy provides comprehensive care. Professional practice requires patient education. Provide expectant mothers with accurate information about oligohydramnios, its risks, and the importance of prenatal care to encourage active participation in their healthcare decisions. As our study shows, early discovery, meticulous monitoring, multidisciplinary collaboration, and patient education can improve oligohydramnios pregnancies. To enhance pregnancy outcomes, doctors can reduce risks, increase mother and foetal well-being, and incorporate these measures into prenatal care.

Strengths and Limitations of the Study

Our prospective cohort design allowed us to track foetal outcomes in relation to oligohydramnios throughout time, a major strength. We recruited from MGMMC & LSK Hospital Kishanganj to eliminate clinical practice variation and increase data consistency. Standardised ultrasonic measurements and tight inclusion criteria improve our results' validity and dependability. A sample size of 100 is enough to detect statistically significant differences in the major outcomes, but it may be too small to draw inferences about the population. We need larger, more geographically diverse studies to confirm our findings and examine racial and regional disparities in oligohydramnios' effects on foetal health. Retrospective data collection for maternal characteristics and medical history may introduce recall bias or insufficient data, despite structured interviews and medical record checks.

Recommendations for Further Research

Longitudinal studies are needed to assess the long-term consequences of oligohydramnios on neurodevelopment and growth. Understanding the effects of intrauterine growth restriction and early gestational age at delivery should improve childhood development, early intervention, and paediatric care. Prenatal treatments that target oligohydramnios risk factors must be tested to enhance amniotic fluid volume and foetal outcomes. Studying how maternal hydration, nutritional, and pharmaceutical treatments affect amniotic fluid dynamics could improve prevention and therapeutic management. Prospective studies should use 3-dimensional ultrasound or MRI to examine foetal morphology and functional outcomes in oligohydramnios. These technological advances may help us understand the pathophysiological processes that underlie oligohydramnios, which could improve clinic diagnosis and treatment.

Conclusion

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Our prospective cohort study at MGMMC and LSK Hospital Kishanganj strongly suggests that oligohydramnios impacts foetal development and growth. In a 100-person sample, oligohydramnios pregnancies had lower birth weights and earlier gestational ages. Oligohydramnios women had increased foetal pain and NICU hospitalisations. These findings underline the necessity of appropriate amniotic fluid levels for foetal health. Our work promotes prenatal oligohydramnios identification and therapy by identifying these negative effects. This strategy uses ultrasound-monitored amniotic fluid, foetal growth, and preterm birth prevention drugs. Our research has illuminated oligohydramnios' clinical implications, including intrauterine disturbance and poor infant outcomes. This information helps healthcare providers tailor oligohydramnios treatment and counselling to pregnant women to improve mother and baby outcomes.

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