

Fetomaternal Outcomes in Pregnancies Complicated with Oligohydramnios at a Teaching Hospital in Western Kenya

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Abstract

Background

Oligohydramnios is an amniotic fluid index (AFI) ≤ 5.0 cm, regardless of gestational age. It complicates about 4.5% of all pregnancies and up to 12% of pregnancies that last beyond 41 weeks. These complications include increased caesarean sections, preterm delivery, cord compression, low Apgar score, intra-uterine growth restriction (IUGR), intra-uterine foetal death (IUFD), increased admissions to newborn unit (NBU) and perinatal mortality. Despite the posited foeto-maternal complications, limited local studies describing their extent exist.

Objective

To compare foeto-maternal outcomes in pregnancies complicated with oligohydramnios to those with normal AFI at gestational age of 28–40 weeks.

Methods

This was a prospective cohort study conducted among expectant women attending high-risk antenatal clinics or admitted to labour and antenatal wards of Moi Teaching and Referral Hospital (MTRH) between September 2019 and August 2020 at a gestational age of 28–40 weeks. The expectant women were stratified based on their exposure status to oligohydramnios in a ratio of 1:3. They were then followed immediately after delivery to determine immediate pregnancy outcomes. Perinatal mortality information was obtained within 7-days after delivery. Fisher's exact test was used to compare oligohydramnios status and foeto-maternal outcomes using a critical value of ≤ 0.05 . A logistic regression model was used to determine the effect of confounders (hypertension and prematurity) on foeto-maternal outcomes. Relative Risks (RR) for adverse outcomes were computed at 95% confidence interval.

Results

We enrolled 252 women, 63 of whom had oligohydramnios (exposed) and 189 without (non-exposed), with a combined mean age of 26.8 (± 5.9) years. They had nearly equal proportions based on their level of education, marital status and employment status. Hypertension was more prevalent among more than half of women with oligohydramnios compared to 17.5% of those without. The most common mode of delivery among women with oligohydramnios was caesarean section at 55.6% compared to 23.3% without. There was no statistically significant difference in the 5-minute APGAR score between the exposed and non-exposed women, with nearly equal proportions of neonates admitted to the NBU among both groups of women, with no statistical difference; with the main indication for admission

being prematurity ($p = 0.001$). There was a five-fold increased risk of perinatal mortality ($RR = 5.000$; 95% CI: 1.632, 15.315) among women with oligohydramnios compared to those without ($p = 0.003$).

Conclusions

This study reports that more than half of women with oligohydramnios had a caesarean section compared to one-quarter of those without the exposure. Most exposed women gave birth to neonates with a low 5-minute APGAR score (< 7); however, this relationship was not statistically significant. Oligohydramnios did not significantly increase the risk of admission to the NBU; however, prematurity was significantly associated with increased NBU admission. The overall risk for perinatal mortality was significantly higher among women with oligohydramnios compared to those without.

Introduction

Amniotic fluid (AF) serves as a cushion for the developing foetus and enables normal development of the foetal urinary system, musculoskeletal system, respiratory and gastrointestinal system. It also provides a sterile and thermally controlled environment for continued foetal growth in a non-restricted environment. Oligohydramnios is defined as an amniotic fluid index (AFI) ≤ 5.0 cm, irrespective of the gestational age of the expectant mother. Oligohydramnios is a major obstetric concern as it affects approximately 4.5%-12% of all pregnancies globally.¹ Beyond 41 weeks of gestation, it complicates as many as 12% of pregnancies.² Previous studies conducted in other jurisdictions have noted that oligohydramnios increases the risk of adverse pregnancy outcomes such as poor foetal lung development, pulmonary hyperplasia, congenital renal disease, and an increased risk of intrauterine foetal death. Among expectant women with oligohydramnios in labour, it is common to note umbilical cord compression, which leads to foetal distress and which increases the risk for caesarean delivery and subsequent poor 5-minute Apgar score of less than 7.³

Despite this finding, other studies have argued that oligohydramnios alone is a poor predictor of adverse perinatal outcomes. This conflicting evidence could interfere with the level of attention oligohydramnios receives from healthcare workers managing women diagnosed with the condition in antenatal clinical settings and labour wards. Increasingly, caesarean deliveries and induction of labour have been used by most clinicians to better perinatal outcomes in such patients. Furthermore, it has been noted that there are limited local studies conducted within the African continent and other countries with developing economies to describe the extent of the problem among expectant women. This necessitates a local study to determine foeto-maternal outcomes in pregnancies complicated with oligohydramnios.

There is need to determine the pregnancy outcomes among women diagnosed with oligohydramnios in Kenya and other countries with developing economies. This knowledge will influence the level of medical attention given to expectant women diagnosed with oligohydramnios and improve on the perinatal outcomes of both the mother and the newborn. The findings from this study could be utilized by both

obstetricians, healthcare workers and policy makers in coming up with optimal algorithms to manage this obstetric concern. Currently, there are no standard guidelines and protocols on the management of expectant women with oligohydramnios attending Moi Teaching and Referral Hospital (MTRH) which is a major healthcare facility managing women with oligohydramnios in Western Kenya. Therefore, this study aimed to generate local data to inform the development of hospital-based guidelines and protocols for managing expectant women with oligohydramnios. It determined the foetal and maternal outcomes in pregnancies complicated with Oligohydramnios at gestational age of 28 weeks to 42 weeks compared to those with a normal amniotic fluid volume at MTRH. Specifically, we compared the mode of delivery between the pregnancies complicated with oligohydramnios and those with a normal amniotic fluid volume, as well as the difference in the 5-minute APGAR score of babies born from women with pregnancies complicated with oligohydramnios and those with a normal amniotic fluid volume. Furthermore, we evaluated the proportion of newborns from mothers with oligohydramnios admitted to the newborn unit compared to those born of mothers with a normal amniotic fluid, and the proportion of early and late perinatal mortality between newborns from women with pregnancies complicated with oligohydramnios and those with a normal amniotic fluid volume.

Methodology

We conducted a prospective cohort study to assess the foeto-maternal outcomes in mothers presenting with and without Oligohydramnios at Moi Teaching and Referral Hospital. It is a level six hospital situated in Eldoret, Uasin Gishu County, offering a wide range of services. The hospital has a catchment of more than 16.24 million people from western Kenya and the neighbouring countries, including Uganda, South Sudan, Burundi, and Rwanda (MTRH records 2018). It caters mainly for the middle- and low-income patients. It is the main teaching hospital for the College of Health Sciences, Moi University, with a bed capacity of 980 beds (MTRH records 2019). The maternity wing of MTRH, also known as Riley's mother and baby hospital (RMBH), conducts an average of 12,000 deliveries annually, 3,000 (25%) of which are caesarean deliveries. The maternity wing has a newborn unit (NBU) and neonatal intensive care unit (NICU) that is served by both paediatricians, neonatologists, paediatric residents, and nurses. The newborn unit admits approximately 200 newborn babies monthly, two-thirds of whom are born within the maternity unit, with the rest being referrals from other facilities.

We enrolled expectant mothers admitted to the antenatal and labour wards or attending high-risk antenatal clinics. They had a Gestational age of between 28 and 42 weeks with a radiological diagnosis of oligohydramnios (within 2 weeks before enrolment into the study). Women with premature rupture of membranes, multiple pregnancies or previous scars were excluded. The expectant women were stratified based on their exposure status to oligohydramnios in a ratio of 1:3. Using Hulley's Difference in Proportions formula,⁴ a sample size of 63 women with oligohydramnios was obtained. These women were matched with those without oligohydramnios (based on age, parity and gestational age) in a ratio of 1:3, giving a sample size of 252 (63 exposed and 189 non-exposed). The participants and their newborns were followed up (by both the principal investigator and research assistant) from enrolment at

gestational age ≥ 28 weeks to delivery; while their newborns were followed up for 28 days post-delivery to assess for perinatal mortality. This study assessed the participants at the time of delivery to determine the mode of delivery as either caesarean section or spontaneous vaginal delivery. It then assessed the APGAR score of the newborns at 5 minutes and confirmed whether the neonates were admitted to the newborn unit. Lastly, it assessed the number of neonates that died immediately after birth and those that died within four weeks of birth.

Specifically, the diagnosis of oligohydramnios was made based on an ultrasound done at MTRH. Once the exposed women were confirmed to meet the eligibility criteria, a written informed consent form was administered prior to enrolment. A structured questionnaire was also used after enrolment to collect the participants' socio-demographic, obstetric characteristics, and their biodata. For those without oligohydramnios who met the eligibility criteria, they were matched in a ratio of 1:3 to the exposed group, enrolled, and data collected using the same approach as the exposed women. All study participants admitted through labour ward were assessed to confirm if in active phase of labour or in latent phase. Those in active phase proceeded to labour rooms for delivery while those in latent phase were transferred to Ante-natal ward for either conservative management or induction of labour depending on their gestational age or other obstetric indications. Similarly, those admitted through the high-risk clinic were admitted to anti-natal ward for conservative management or induction of labour. After delivery, these mothers were transferred to post-natal wards if they had delivered via CS, had a maternal disease of concern (such as PET or diabetes mellitus or had other complications during delivery. Those who had an uneventful delivery were transferred to the hostels. The postnatal wards, hostels and newborn units acted as the study's exit points for both the mothers and their newborns. The newborns were then followed up after 28 days over a phone call in order to evaluate the perinatal mortality rate within 4 weeks post-delivery. Points of contact were therefore during admission and recruitment, during delivery, after delivery and 28 days post-delivery (late perinatal period).

Data analysis and presentation was done using SPSS version 24. Categorical variables were summarized as frequencies and percentages. Mode and mean were used to summarize continuous variables. Analysis for mode of delivery proportions among both exposed and non-exposed women, as well as the APGAR scores, proportion of newborns admitted to NBU, and perinatal mortality was conducted descriptively by cross-tabulating oligohydramnios status against the foetal and maternal outcomes of interest. Pearson chi-square and Fisher's exact tests were used to determine if there was a statistically significant association between oligohydramnios status and mode of delivery, Apgar score at 5 minutes, admission to NBU, and perinatal mortality using a critical value of $p \leq 0.05$. For variables that were statistically significant on Fisher's exact test, a multivariate logistic regression was conducted while controlling for confounders. Relative risks for maternal outcomes (Caesarean sections) and foetal (NBU admission, poor 5-minute APGAR score, early and late perinatal mortality) were computed at 95% confidence interval. Ethical approval was sought from the institutional research and ethics committee (IREC) at Moi University School of Medicine (Approval #0003386). A written informed consent form was administered to every participant before enrolment.

Results

Among women with oligohydramnios, the mean age was 26.8 ($\pm$ 5.9) years with the youngest being 18 years old while the oldest was aged 40 years with a similar mean age of 26 years among those with a normal amniotic fluid index (AFI). The participants were proportionately matched by age, gestational age (by date) and parity in a ratio of 1:3. Majority of all the women enrolled had a minimum of secondary school level of education with a higher proportionate representation (57.1%) among women with oligohydramnios. There were nearly equal proportions of married participants among women with oligohydramnios and normal AFI at 76.2% and 77.8% respectively, however, majority of both exposed and non-exposed women were not employed. Hypertension was found to be more prevalent among exposed (55.6%) compared to the non-exposed (17.7%) with an equal frequency ($n = 1$) of diabetes for both groups. There were no cases of epilepsy and rheumatic heart disease (RHD) reported among the non-exposed; however, 1 (1.6%) woman with oligohydramnios had epilepsy while another had rheumatic heart disease. No Hepatitis B virus infection was reported among those with oligohydramnios. However, one control had the infection. Nifedipine was the most used medication among exposed and non-exposed at 14 (22.2%) and 24 (15.0%), followed by a combination of nifedipine and methyldopa among 4 (6.3%) women with normal AFI (Table 1).

Table 1
Participants' Sociodemographic and Clinical Characteristics

Sociodemographic Characteristic		Oligohydramnios N = 63; n (%)	Normal AFI N = 189; n (%)
Age (in years)	Mean (SD)	26.8 (± 5.9)	26.8 (± 5.5)
Parity	0	29 (46.0)	87 (46.0)
	1	12 (19.0)	36 (19.0)
	2	9 (14.3)	27 (12.7)
	3	6 (9.5)	18 (9.5)
	4	3 (4.8)	9 (4.8)
	≥ 5	4 (6.3)	12 (6.3)
Gestational Age	40 + 1–42 + 0	12(19.0)	36 (19.0)
	38 + 1–40 + 0	11 (17.5)	33 (17.5)
	36 + 1–38 + 0	8 (12.7)	24 (12.7)
	34 + 1–36 + 0	11 (17.5)	33 (17.5)
	32 + 1–34 + 0	9 (14.3)	27 (14.3)
	30 + 1–32 + 0	4 (6.3)	12 (6.3)
	28 + 0–30 + 0	8 (12.7)	24 (12.7)
Level of Education	Primary	11 (17.5)	42 (22.3)
	Secondary	36 (57.1)	98 (51.9)
	Tertiary	16 (25.4)	49 (25.9)
Marital Status	Single	15 (23.8)	44 (23.3)
	Married	48 (76.2)	145 (76.7)
Employment Status	Unemployed	44 (69.8)	127 (67.2)
	Business	8 (12.7)	18 (9.5)
	Casual Labor	2 (3.2)	21 (11.1)
	Farmer	4 (6.3)	12 (6.3)
	Formal Employment	5 (7.9)	11 (5.8)
Hypertension	Yes	35 (55.6)	33 (17.5)
Diabetes	Yes	1 (1.6)	2 (1.1)

Sociodemographic Characteristic		Oligohydramnios N = 63; n (%)	Normal AFI N = 189; n (%)
Other Medical History	Epilepsy	1 (1.6)	-
	RHD	1 (1.6)	-
	Hepatitis B	-	1 (0.5)
Medication (N = 43)	Adalat (Nifedipine)	15 (71.4)	19 (86.4)
	Aldomet (Methyldopa)	-	1 (2.3)
	Adalat + Aldomet	4 (19.0)	1 (4.5)
	Antiepileptic	1 (4.8)	-
	Panada + Aldomet	1 (4.8)	-
	Glucophage + Adalat + Aldomet	1 (1.6)	1 (4.5)

The most common mode of delivery among more than half (55.6%) of the exposed was caesarean section while majority (76.6%) of the non-exposed gave birth through spontaneous vaginal delivery (SVD). Women with oligohydramnios had a significantly ($p < 0.001$) increased risk of caesarean deliveries compared to those without ($RR = 1.505$; 95% CI: 1.223, 1.851) as shown on Fig. 1. The most cited reasons for caesarean section among the exposed were NRFS ($n = 21$) and severe PET ($n = 9$). Pre-eclampsia did not significantly increase rate of caesarean delivery amongst women with pregnancies complicated with oligohydramnios (Fig. 1).

The mean APGAR score among babies born to mothers with oligohydramnios (exposed) was 7.35 (± 3.51) with a median value of 9 (IQR: 7, 10). Among the non-exposed, the mean APGAR score was 8.92 (± 1.87) with a median value of 10 (IQR: 8.75, 10.00). The proportion of women with oligohydramnios having a low 5-minute APGAR score of less than 7 was 7.3%. There was no statistically significant association between a woman's oligohydramnios status and the newborn's 5-minute APGAR score. There was a higher proportion (28.6%) of neonates born from mothers with oligohydramnios who were admitted to the newborn unit compared to non-exposed (22.8%). Overall, 61 (24.2%) of all neonates from the study participants were admitted to the newborn unit. When a Fischer's exact test was conducted on this bivariate relationship, there was no statistically significant association between having oligohydramnios and admission to the newborn unit. Despite the lack of a statistically significant association between oligohydramnios as a risk factor for admission to the newborn unit, women with oligohydramnios were more likely to have their newborns admitted to the newborn unit ($RR = 1.252$, 95% CI: 0.787, 1.993). The major indications for NBU admission assessed in this study were prematurity, mild respiratory distress syndrome (RDS), severe RDS and birth asphyxia. This study further reports that prematurity was a significant ($p = 0.001$) indication for NBU admission (56.6%) among newborns born to mothers with oligohydramnios and those without (Table 2).

Table 2
Indications for NBU Admission

Reason for NBU Admission	Oligohydramnios status		Total	p-value
	Exposed	Non-Exposed		
Prematurity	13 (50%)	30 (60%)	43 (56.6%)	0.001
Mild RDS	8 (30.8%)	14 (28%)	22 (28.9%)	> 0.05
Severe RDS	3 (11.5%)	3 (6%)	6 (7.9%)	> 0.05
Asphyxia	2 (7.7%)	3 (6%)	5 (6.6%)	> 0.05
Total	26	50	76	

When a multivariate logistic regression was conducted on prematurity (while controlling for other reasons for NBU admission), there was a two-fold (RR = 2.592; 95% CI: 1.601, 4.197) statistically significant (**p < 0.001**) risk of NBU admission among newborns aged less than 34 weeks compared to those aged 34 weeks or more. This study reports an immediate perinatal mortality of 8 (12.7%) of the exposed and 4 (2.5%) non-exposed. When a Fischer's exact test of association was conducted, a statistically significant association (p = 0.001) was obtained. Neonates born of mothers with oligohydramnios were more likely to die immediately after birth compared to those born of mothers with a normal AFI (RR = 8.000; 95% CI: 2.189, 29.234).

On follow-up after discharge (after 28 days), it was determined that an additional 2 newborns from women with oligohydramnios died while one from those without the oligohydramnios died too. This brought an overall incidence of neonatal mortality of 15.9% (n = 10) from women with oligohydramnios compared to 3.2% (n = 5) among women with a normal AFI (Table 4.11). When a bivariate test of association was conducted, it was determined that oligohydramnios significantly (p = 0.001) increased the risk of neonatal mortality within the first 28 days of life fivefold (RR = 5.000; 95% CI: 1.893, 13.205).

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Table 3: Overall (late) Perinatal Mortality within 28 days of life

Oligohydramnios status	Follow-up after 7 days		Total	p-value/ RR (95% CI)
	Baby Died	Baby Alive		p=0.001
Yes	10 (15.9%)	53 (84.1%)	63	RR=5.000 (1.893,13.205).
No	6 (3.2%)	153 (96.8%)	189	
Total	16 (6.8%)	206 (93.2%)	252	

Discussion

Comparison of the mode of delivery between women with and without oligohydramnios.

This study enrolled 63 women with oligohydramnios of which a higher (55.6%) proportion of them gave birth through caesarean sections. A finding that is lower than many studies under comparison. In Sudan, the authors⁵ determined that 69.1% of women with oligohydramnios gave birth through caesarean sections; a finding that is higher than that reported in the current study. A much higher caesarean section proportion of 85% was reported in Nepal among women with oligohydramnios. In a study conducted in India⁶, oligohydramnios was significantly associated with caesarean sections (96.6%) indicated for fetal distress among women with an oligohydramnios diagnosis. This could be attributed to high caesarean sections in the two countries. However, the findings of this study are higher than those reported in Asam, India⁷ where 50% of women with Oligohydramnios underwent a caesarean section. Similar lower rates were reported in Tel Aviv, Israel⁸ at 47.2%.

The most common cited reason for Caesarean delivery was Non-Reassuring Fetal status (NRFS) in the current study (62.8%) followed by PET (25.7%). These results compare with a study in Nasik, India⁹ where 53% of the women who underwent Caesarean section had a diagnosis of NRFS. In Sudan¹⁰, 86.8% of the pregnant women with Oligohydramnios who delivered via a caesarean section had a diagnosis of NRFS. However, only 22% of those who delivered via Caesarean section had a diagnosis of NRFS in both Rajnandgaon, India¹¹ and Rajshahi, Bangladesh.¹² These differences could be attributed to difference in inclusive and exclusive criteria in different studies across different centres.

Comparison of APGAR score at 5 minutes among babies born by mothers with Oligohydramnios compared to those without

This study determined that the mean 5-minute APGAR score was 7.35 ($\pm$ 3.51) and 8.92 ($\pm$ 1.87) for women with and without oligohydramnios respectively. The proportion of women with oligohydramnios having a low 5-minute APGAR score of less than 7 was 7.2%. This was more than two-times that of women without oligohydramnios at 3.2%. The 5-minute APGAR score findings of this study are higher

than other studies which reported a low 5-minute APGAR score among 4%^{13,14} and 3.8%¹⁵ of the study participants with oligohydramnios. Neonates born of mothers diagnosed with oligohydramnios will have a greater likelihood of having low 5-minute APGAR scores because of cord compression by the fetal head which leads to intermittent or continuous hypoxia.

In New Delhi-India¹³, the authors found that 4% of mothers with Oligohydramnios gave birth to neonates with a 5-minute APGAR score of less than seven compared to 3.4% of those without Oligohydramnios. Similarly in India¹⁶, 4% of women diagnosed with Oligohydramnios gave birth to neonates with a 5-minute APGAR score of < 7 compared to 2% of the controls. These similarities could be attributed to comparable study design and sampling technique. However, in a different study conducted at the Johns Hopkins Hospital in the United States of America between the year 1999 and 2002¹⁵ an inverse relationship was reported whereby 3.8% of the cases had neonates with a 5-minute APGAR score of < 7 compared to 4.6% of the controls. This difference could be attributed to temporal difference in study findings as technology and patient management techniques improve, raising questions if the Oligohydramnios group was given more attention in management since the group had already been tagged as a high-risk group. A similar inverse relationship was reported in Turkey¹⁷ where 7.8% of the exposed had newborns with a low five-minute APGAR score compared to 10% of the controls. These differences could be because of the eligibility criteria for participating in the Turkish study¹⁷ where majority of the newborns were preterm (28/0–36/6 weeks) compared to a mix of term and preterm newborns in the current study. In contrast to this study's findings, higher proportions (10%) of low 5-minute APGAR score were reported in Chennai-India compared to 4% of the controls¹⁸.

Proportion of babies born by mothers with Oligohydramnios admitted to newborn unit (NBU)

Nearly one-third (28.6%) of the newborns from mothers diagnosed with Oligohydramnios were admitted to the newborn unit compared to 22.8% of the non-exposed. This finding is close to that reported in Peshawar-Pakistan¹⁹ at 31% and Turkey¹⁷ at 29.4% but much lower than the 38.6%²⁰ reported in Bihar-India. However, the findings of this study are higher than the 25.3% in Erbil-Iraq²¹, and 20% in Baroda²² among women with isolated Oligohydramnios in Baroda-India, because majority of the study participants in these two studies had a gestational age of at or above 37 weeks. This was also the case in an Indian study²³ where 19.2% of the newborns from the exposed were admitted to the newborn unit. Furthermore, much lower proportions were reported in Nepal²⁴ at 5% and Wardha-India²⁵ at 4.2%. This difference could be attributed to the fact that these studies had enrolled mothers with term gestational age compared to the current study which had both preterm and term gestations.

Neonatal Mortality among women with Oligohydramnios compared to non-exposed

This study followed the women for 28 days from the delivery date to determine neonatal mortality proportion, of which 15.9% of those born from the exposed group died while neonatal mortality proportion among the non-exposed was 3.2%. This finding mirrors that in Kilpauk-India¹⁶ that reported an overall neonatal mortality rate of 14% among women with oligohydramnios. However, lower neonatal mortality proportion was reported in India at 6%²⁶ among women with oligohydramnios and a gestational age of 34 weeks or more. In the Routine Antenatal Diagnostic Imaging with Ultrasound (RADIUS) trial conducted in the United States of America²⁷, it was reported that 5.1% of the neonates born of mothers with oligohydramnios died. At the Silchar Medical College and Hospital in India,²⁸ neonatal mortality proportion was reported at 8.6%, which is lower than that reported in this study. This is despite both studies using a prospective cohort design. However, in a different study conducted in India among 50 women with oligohydramnios in a ratio of 1:1,²⁹ no neonatal mortality was reported among both the exposed and non-exposed.

Conclusions

In this study, more than half of the women with oligohydramnios gave birth through Caesarean section compared to a quarter of those with normal amniotic fluid volume. Higher proportions of caesarean section was reported among women with oligohydramnios, majority of whom were also diagnosed with pre-eclampsia toxemia (PET). A low 5-minute APGAR score of less than 7 was common among newborns born of mothers with oligohydramnios compared to those born of mothers without oligohydramnios. Oligohydramnios did not significantly increase the risk of admission to newborn unit; however, prematurity significantly increased the likelihood of admission more than two-folds. Lastly, this study reports an overall neonatal mortality proportion of 15.9% among those born of women with oligohydramnios compared to the 3.2% among those born of women without oligohydramnios. Being born of a mother with oligohydramnios increase the risk of neonatal mortality five-fold.

Recommendations

There is a need for early identification and management of hypertension in pregnancy (PET) a risk factor for oligohydramnios among expectant women to reduce their likelihood of caesarean section. Although oligohydramnios did not significantly increase the likelihood for low 5-minute APGAR score and NBU admission, there is need for a multidisciplinary approach that engages all maternal and child health professionals such as obstetricians, neonatologists, and paediatricians, to improve neonatal outcomes. Healthcare workers should conduct continuous intrapartum fetal monitoring during labour and provide good neonatal care to reduce on neonatal mortality. More longitudinal studies in other clinical settings should be conducted to determine the effect of oligohydramnios on faeto-maternal outcomes, while controlling for prematurity as a confounding factor.

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Figures

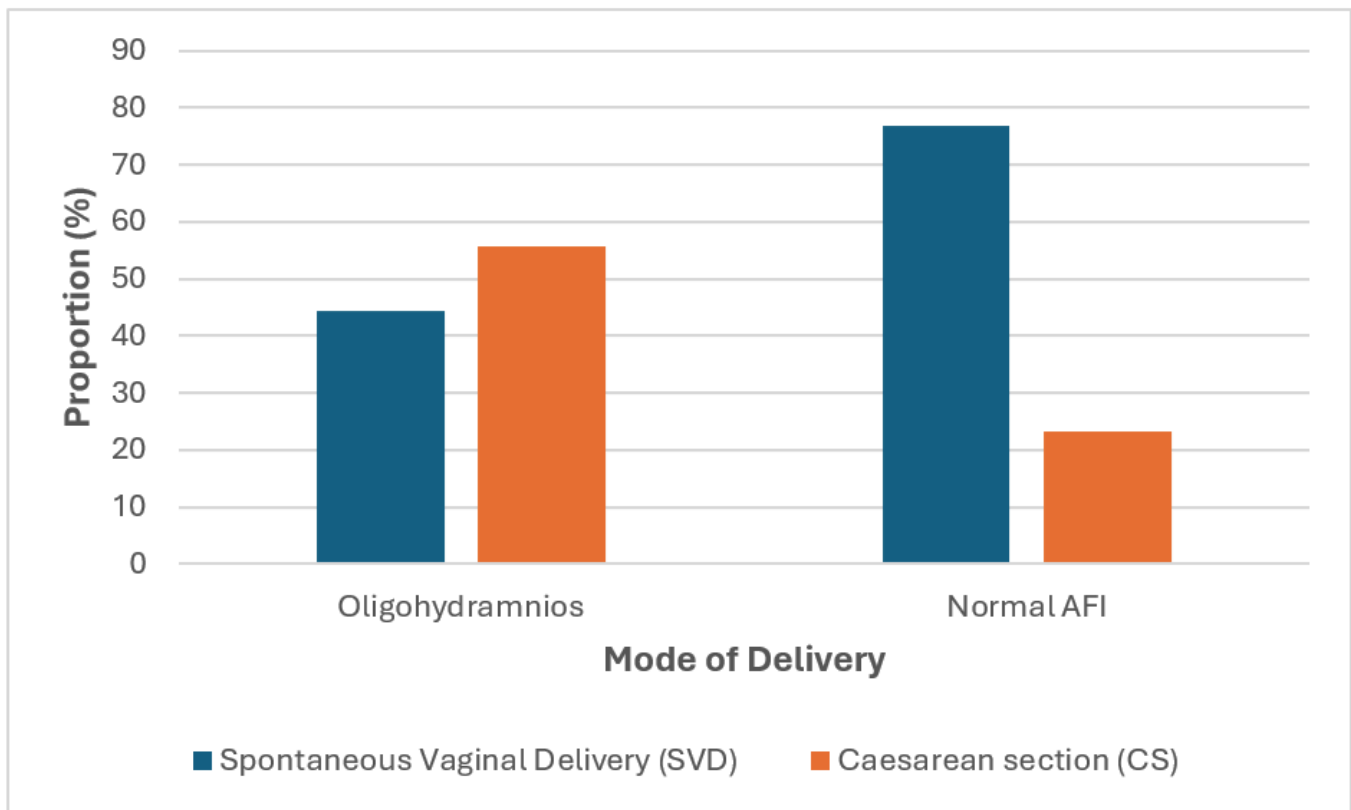


Figure 1

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