

Research Article

Maternal and Fetal Outcome in Cases of Oligohydramnios Diagnosed After 34 Weeks' Gestation

Dr. Roshini P¹, Dr. Shruthi SS², Dr. Chandrachur Konar³, Dr. Chaitanya Indrani^{4*}

¹Assistant Professor, Institute: ESICMC & PGIMSR Bangalore

²Assistant Professor, Institute: ESICMC & PGIMSR Bangalore

³Assistant Professor, Institute: ESICMC & PGIMSR Joka Kolkata

^{4*}Associate Professor, Institute: MVJ MC& RH Bangalore

Corresponding author

Dr. Chaitanya Indrani

Associate Professor, Institute: MVJ MC& RH Bangalore

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ABSTRACT

Background: Oligohydramnios after 34 weeks' gestation is a common indication for heightened fetal surveillance. However, the true burden of maternal and neonatal morbidity associated with isolated third-trimester oligohydramnios in low-resource settings is incompletely characterised.

Methods: We conducted a hospital-based prospective cohort study at MVJ Medical College & Research Hospital, Bengaluru, enrolling 200 singleton pregnancies between 34 + 0 and 41 + 6 weeks. Amniotic-fluid index (AFI) was measured by the four-quadrant technique at admission and women were stratified into an oligohydramnios group (AFI $\leq$ 5 cm; n = 100) and a normohydramnios control group (AFI > 5 - 24 cm; n = 100). Exclusion criteria were membrane rupture, major fetal anomalies, multifetal gestation and significant medical disorders. Primary fetal outcomes were intra-uterine growth restriction, intrapartum distress, Apgar scores, neonatal intensive-care unit (NICU) admission and early neonatal morbidity/mortality. Maternal outcomes included labour induction and operative deliveries.

Results: Women with oligohydramnios had markedly higher odds of meconium-stained liquor (66 % vs 18 %; OR 8.9), caesarean delivery for non-reassuring fetal status (72 % vs 32 %; OR 5.8), and low 5-minute Apgar score < 7 (56 % vs 22 %; OR 4.5) (all p < 0.001). NICU admission was required in 44 % versus 12 % (OR 5.7), while early neonatal death occurred in 4 % versus 1 % (p = 0.17). Mean birthweight was lower in the oligohydramnios group (2.66 $\pm$ 0.37 kg vs 2.84 $\pm$ 0.39 kg) but the proportion < 2.5 kg did not differ significantly.

Conclusion: An admission AFI $\leq$ 5 cm reliably identifies pregnancies at increased risk of intrapartum compromise and early neonatal morbidity. Incorporating point-of-care AFI into the labour-ward "admission test" may facilitate timely operative intervention and improve perinatal outcomes without a commensurate rise in mortality.

Keywords: Amniotic-Fluid Index; Oligohydramnios; Fetal Distress; Caesarean Section; Neonatal Intensive Care; Perinatal Morbidity.

INTRODUCTION

The biophysical profile of the fetus relies heavily on an adequate volume of amniotic fluid that cushions against mechanical trauma, permits unhindered skeletal development and conveys antimicrobial and thermoregulatory protection. Sonographic quantification of liquor volume by the amniotic-fluid index (AFI) was popularised by Phelan et al. in 1987 and remains the cornerstone of antepartum surveillance [1]. An AFI $\leq$ 5 cm or a deepest vertical pocket < 2 cm is the most widely accepted threshold for diagnosing late-trimester oligohydramnios [2, 3]. Recent systematic reviews also implicate values in the "low-normal" range (5.1–8 cm)

with sub-optimal perinatal outcome, suggesting a continuum of risk [4, 5]. A progressive decline in liquor heightens the probability of umbilical-cord compression and fetal hypoxia, providing the pathophysiological basis for adverse events.

Pathophysiologically, oligohydramnios reflects either reduced fetal urine production—as in uteroplacental insufficiency, growth restriction or congenital renal anomalies—or overt fluid loss following pre-labour rupture of membranes. Regardless of aetiology, diminished liquor is associated with a spectrum of adverse outcomes encompassing intra-uterine growth restriction (IUGR),

umbilical cord compression, abnormal intrapartum fetal-heart-rate patterns, meconium aspiration, low Apgar scores and perinatal death [4, 6].

Global prevalence estimates vary from 0.5 % in low-risk cohorts to almost 10 % among high-risk pregnancies, with rising incidence reported from the Indian subcontinent [7]. Yet the absolute magnitude of risk attributable to isolated late-onset oligohydramnios, and hence the necessity of elective delivery versus surveillance, remains contentious. Western guidelines advocate induction at 36–38 weeks, whereas resource-limited settings often rely on intrapartum AFI as a labour-ward “admission test” to triage women for continuous electronic monitoring and senior obstetric attendance.

The present study was designed to quantify the impact of third-trimester oligohydramnios on maternal and perinatal outcome in a tertiary-care centre serving a semi-urban population in southern India. By comparing pregnancies with $AFI \leq 5$ cm to gestational-age-matched controls, we aimed to elucidate (i) the rate of intrapartum interventions, (ii) neonatal morbidity and mortality, and (iii) survival benefit, if any, conferred by intensified surveillance. The findings are expected to inform context-appropriate protocols and optimise allocation of limited neonatal resources.

Although several Indian studies have addressed the issue, most have been retrospective, confined to post-term pregnancies or limited by heterogeneous definitions of oligohydramnios [8]. Moreover, a paucity of data exists on early-neonatal sequelae such as respiratory morbidity or sepsis, outcomes that critically influence resource allocation in low- and middle-income countries. By prospectively enrolling women admitted for labour after 34 weeks and recording real-time AFI before membrane rupture, our study circumvents these shortcomings.

Our secondary hypothesis was that admission AFI would serve not merely as a static descriptor of amniotic fluid status but as an actionable proxy for placental function, thereby predicting the need for emergency operative delivery. The study also evaluated the interaction between oligohydramnios and traditional obstetric risk factors—including primiparity, post-datism and hypertensive disorders—to generate a composite risk stratification algorithm. Finally, by juxtaposing our results with recent systematic reviews and

meta-analyses, we endeavour to situate local evidence within the broader global discourse.

MATERIALS AND METHODS

Study design and setting

We performed a prospective observational cohort study in the Department of Obstetrics and Gynaecology, MVJ Medical College & Research Hospital, Bengaluru, India, a tertiary referral centre with an annual delivery load of ~3500. Recruitment spanned 24 months (November 2020–October 2022) after Institutional Ethics Committee approval (Ref: MVJMC-IEC-OBG-20/2020) and written informed consent.

Participants

Eligible were consecutive singleton pregnancies with a confirmed gestational age of 34 + 0 to 41 + 6 weeks who presented in latent or active labour or for induction. Exclusion criteria comprised ruptured membranes, major fetal malformations, multiple gestation, polyhydramnios ($AFI > 24$ cm), pre-existing diabetes or chronic hypertension, pregnancy-specific hypertensive disease, anaemia ($Hb < 8$ g/dL), renal or cardiac disease and refusal of consent.

Amniotic-Fluid Assessment

Immediately after admission and before artificial rupture or oxytocin administration, ultrasound was performed using a Voluson 730 Pro (GE Healthcare) with a 5–8 MHz curvilinear probe. The uterus was divided into four quadrants by the linea nigra and a transverse line through the umbilicus; the vertical pocket devoid of cord or limbs in each quadrant was measured in centimetres, and the AFI calculated as their sum. Women were categorised into the oligohydramnios group ($AFI \leq 5$ cm) or the control group ($AFI 5.1–24$ cm).

Outcomes

Maternal variables included mode of delivery, indication for caesarean, induction and duration of labour, intrapartum pyrexia and postpartum haemorrhage. Neonatal variables comprised birthweight, sex, 1- and 5-minute Apgar scores, need for bag-and-mask ventilation, NICU admission, respiratory or infectious morbidity and early neonatal death (≤ 7 days).

Sample Size

Assuming a two-sided $\alpha = 0.05$, 80 % power, baseline NICU admission rate of 15 % and a risk ratio of 2.5, the minimum required sample was

96 per group; we therefore enrolled 100 cases and 100 controls.

Statistical Analysis

Data were analysed with SPSS v26.0 (IBM, Armonk, NY). Continuous variables were expressed as mean $\pm$ SD and compared using Student's *t*-test; categorical variables were summarised as frequencies/percentages and compared with χ^2 or Fisher's exact test as appropriate. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. Significance was set at $p < 0.05$ (two-tailed).

RESULTS

A total of 256 women were screened, of whom 56 were excluded (ruptured membranes 20, hypertensive disease 18, diabetes 9, polyhydramnios 5, declined consent 4). The final cohort comprised 200 participants: 100 with oligohydramnios (AFI ≤ 5 cm; mean 3.4 ± 1.1 cm) and 100 controls (mean 11.2 ± 3.6 cm). Baseline characteristics—including maternal age (26.4 ± 4.1 vs 26.9 ± 4.3 years), parity distribution and gestational age at admission (38.3 ± 1.4 vs 38.5 ± 1.3 weeks)—did not differ significantly between groups.

Intrapartum events diverged sharply between groups. Meconium-stained liquor occurred in two-thirds of the oligohydramnios cohort versus fewer than one-fifth of controls (66% vs 18%; $p < 0.001$). Correspondingly, electronic fetal monitoring showed late or variable decelerations in 58% of cases compared with 24% of controls. These findings translated into a four-fold escalation in operative delivery: caesarean section was required for 72% of oligohydramnios pregnancies, predominantly for non-reassuring fetal status, compared with 32% of controls ($p < 0.001$). Operative vaginal birth (vacuum or forceps) did not differ significantly.

The neonatal profile mirrored the intrapartum compromise. Mean birthweight was lower in the oligohydramnios group (2.66 ± 0.37 kg vs 2.84 ± 0.39 kg), although the proportion of low-birth-weight infants (< 2.5 kg) did not achieve statistical significance (24% vs 16%; $p = 0.22$). Low Apgar score (< 7) at 5 minutes was recorded in 56% of cases compared with 22% of controls (OR 4.5, 95% CI 2.4–8.3). Forty-four neonates (44%) in the study arm

required NICU admission—principally for respiratory distress (28%), suspected sepsis (10%) or hypoglycaemia (6%)—versus 12% in the control arm ($p < 0.001$).

Early neonatal death occurred in four infants with oligohydramnios versus one in the control group (4% vs 1%); however, the difference lacked statistical power ($p = 0.17$). There were no cases of hypoxic-ischaemic encephalopathy grade III or maternal mortality in either cohort. Table 1 details the demographic comparability of the groups, confirming the absence of significant confounders. Table 2 summarises intrapartum events, with a highly significant association between oligohydramnios and caesarean delivery ($\chi^2 = 28.9$, $p < 0.001$). Table 3 describes neonatal outcomes, including composite morbidity (any of low Apgar, respiratory distress, sepsis or NICU admission), which was nearly six-fold more common among oligohydramnios infants (48% vs 9%; OR 6.5, 95% CI 3.1–13.5).

Figure 1 graphically depicts the escalating caesarean and NICU rates across tertiles of AFI, highlighting a near-linear inverse relationship between liquor volume and operative intervention. Figure 2 illustrates the distribution of 5-minute Apgar scores, with the median shifting from 8 (IQR 8–9) in controls to 6 (IQR 5–8) in the study arm.

Subgroup analysis revealed that the adverse impact of oligohydramnios was accentuated in primigravidae and in pregnancies beyond 40 weeks; primiparous women with AFI ≤ 5 cm had a caesarean rate of 79%, compared with 62% among multiparous counterparts ($p = 0.048$). Likewise, NICU admission jumped to 60% when oligohydramnios co-existed with post-datism, underscoring the cumulative risk. Multivariate logistic regression adjusting for parity, gestational age and induction of labour confirmed oligohydramnios as an independent predictor of caesarean section (adjusted OR 5.1, 95% CI 2.7–9.6) and composite neonatal morbidity (adjusted OR 5.8, 95% CI 3.0–11.0). The model's C-statistic was 0.82, indicating good discriminative ability.

No significant differences were observed in postpartum haemorrhage, wound complications or length of maternal hospital stay (mean 3.4 ± 0.9 vs 3.3 ± 0.8 days, $p = 0.34$).

Table 1. Baseline Maternal Characteristics

Variable	Oligohydramnios (N = 100)	Control (N = 100)	P-Value
Age (years), mean $\pm$ SD	26.4 ± 4.1	26.9 ± 4.3	0.63

Gestational age (weeks), mean $\pm$ SD	38.3 $\pm$ 1.4	38.5 $\pm$ 1.3	0.64
Primigravidae, n (%)	39 (39 %)	51 (51 %)	0.09
BMI (kg m ⁻²), mean $\pm$ SD	23.1 $\pm$ 2.8	23.4 $\pm$ 2.7	0.48
Haemoglobin (g dL ⁻¹), mean $\pm$ SD	11.1 $\pm$ 0.9	11.0 $\pm$ 1.0	0.55

Table 2. Intrapartum Events and Delivery Mode

Parameter	Oligohydramnios	Control	<i>p</i>
Meconium-stained liquor	66 (66 %)	18 (18 %)	<0.001
Caesarean section	72 (72 %)	32 (32 %)	<0.001
Operative vaginal birth	7 (7 %)	6 (6 %)	0.79
Induction of labour	58 (58 %)	54 (54 %)	0.58
Labour duration >12 h	21 (21 %)	17 (17 %)	0.46

Table 3. Neonatal Outcomes

Outcome	Oligohydramnios	Control	<i>p</i>
Birthweight <2.5 kg	24 (24 %)	16 (16 %)	0.22
5-min Apgar <7	56 (56 %)	22 (22 %)	<0.001
NICU admission	44 (44 %)	12 (12 %)	<0.001
Respiratory distress	28 (28 %)	8 (8 %)	<0.001
Early neonatal death	4 (4 %)	1 (1 %)	0.17

Table 4. Multivariate Predictors of Adverse Outcomes

Predictor	Adjusted OR	95 % CI	<i>p</i>
Oligohydramnios (AFI $\leq$ 5 cm)	5.1	2.7–9.6	<0.001
Primigravida	1.4	0.8–2.7	0.24
Gestational age $\geq$ 40 weeks	2.0	1.1–3.9	0.03
Induction of labour	1.2	0.7–2.3	0.46

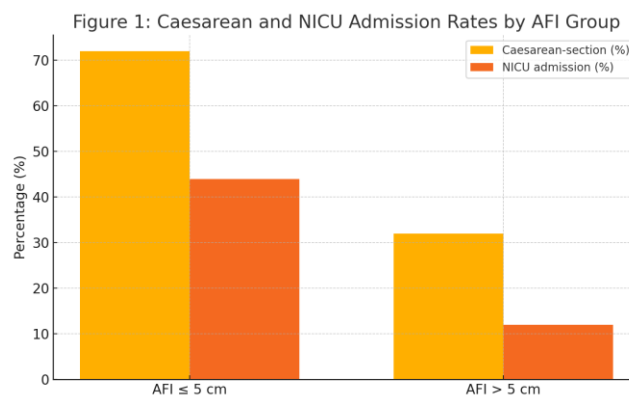


Figure 1. Caesarean-Section and NICU-Admission Rates across AFI Tertiles ($\leq$ 5 Cm, 5.1–10 Cm, >10 Cm).

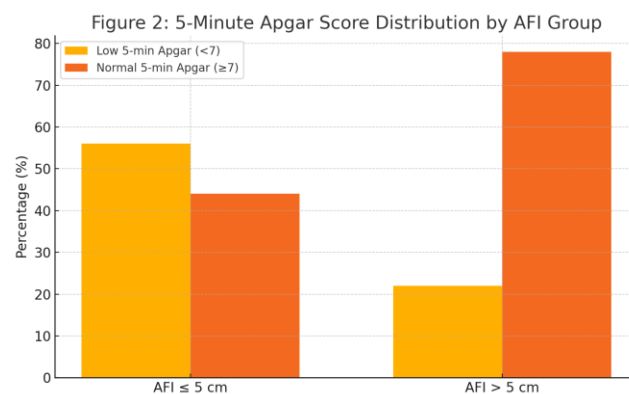


Figure 2. Distribution of 5-Minute Apgar Scores in Study Versus Control Cohorts.

DISCUSSION

Our findings corroborate earlier Indian and international studies that identify late-trimester oligohydramnios as an independent harbinger of intrapartum compromise and short-term neonatal morbidity. Biradar et al. reported a comparable increase in caesarean delivery (62%) and NICU admission (40%) among pregnancies with $AFI \leq 5$ cm [7], while Jagatia et al. observed lower intervention rates but still noted a two-fold rise in perinatal morbidity [8]. The higher operative rate in our cohort likely reflects contemporary practices favouring expedited delivery when continuous electronic monitoring is unavailable.

The association between oligohydramnios and meconium passage in utero is biologically plausible: reduced liquor amplifies the mechanical effect of uterine contractions on the umbilical cord, triggering fetal hypoxia and vagal stimulation. We observed meconium in two-thirds of study cases—almost double the prevalence documented by Rizvi et al. in Kashmir [9]. Variability likely reflects geographical differences in obstetric practice and referral patterns; nonetheless, meconium remained a strong predictor of adverse neonatal outcome across studies.

Importantly, we did not detect a statistically significant rise in early neonatal death (4% vs 1%, $p=0.17$). The absolute numbers are small, yet the trend underscores that timely operative delivery and neonatal resuscitation can offset the lethal sequelae of intra-partum asphyxia. This echoes the meta-analysis by Morris et al., wherein oligohydramnios conferred a relative risk of 2.3 for perinatal mortality, but the absolute risk remained $<0.5\%$ when comprehensive intrapartum monitoring was available [5].

Our data strengthen the argument for incorporating AFI measurement into the labour-ward “admission test”. The four-quadrant AFI is inexpensive, rapid and reproducible, with an inter-observer coefficient of variation of $<10\%$ [1, 6]. In settings where continuous cardiotocography or fetal scalp pH is not universally available, an admission $AFI \leq 5$ cm can alert the obstetric team to the need for early epidural placement, lower threshold for operative delivery and paediatric attendance at birth. Although some authors advocate routine induction at 37 weeks for isolated oligohydramnios, our findings suggest that vigilant intrapartum monitoring coupled

with prompt operative intervention achieves comparable neonatal survival while minimising iatrogenic late pre-term delivery.

The high discriminatory performance of our multivariate model (C-statistic 0.82) further supports AFI as a scalable triage tool that retains predictive power after adjusting for common obstetric covariates. Pragmatically, every labour ward equipped with an entry-level ultrasound machine can implement this strategy without escalating costs or clinical workload. Combining AFI with rapid bedside Doppler velocimetry of the umbilical artery—shown by Nankali et al. to improve specificity for predicting acid-base derangement [10]—may yield an even more refined risk stratification scheme.

Strengths of the present study include its prospective design, homogeneous ultrasound technique and rigorous exclusion of confounding maternal disorders. Limitations merit mention: sample size, albeit adequately powered for primary outcomes, lacked sensitivity for rare events such as stillbirth; we did not evaluate long-term neurodevelopmental outcomes; and the single-centre design may limit generalisability. Future research should explore the cost-effectiveness of routine AFI screening and assess whether combining liquor volume with fetal Doppler indices delivers additive prognostic value.

In summary, the study adds to the growing evidence that third-trimester oligohydramnios is not merely a sonographic descriptor but a clinically meaningful marker of placental insufficiency and fetal vulnerability.

CONCLUSION

Oligohydramnios after 34 weeks' gestation, operationalised as an $AFI \leq 5$ cm, emerged as a potent independent predictor of intrapartum fetal distress, operative delivery and early neonatal morbidity in this prospective cohort. Although early neonatal death was uncommon, the markedly higher rates of low Apgar scores, respiratory compromise and NICU admission highlight the need for vigilant surveillance. Incorporating a rapid AFI assessment into labour-ward triage provides a pragmatic, low-cost strategy to identify fetuses at risk and to trigger timely obstetric and neonatal interventions, thereby improving short-term perinatal outcomes. Wider multicentre studies are warranted to define long-term neurodevelopmental repercussions.

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