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COMPARISON OF FETAL RENAL ARTERY DOPPLER IN PATEINTS WITH OR WITHOUT OLIGOHYDRAMNIOS IN 3rd TRIMESTER

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ABSTRACT

Background: *When the amniotic fluid index (AFI) is less than 5 cm or the single deepest pocket is less than 2 cm, the medical condition known as oligohydramnios occurs. At any stage of pregnancy, 3–4% of expecting women have low amniotic fluid. About 1% to 5% of pregnancies result in oligohydramnios. According to prospective research at the University of Texas South-Western Medical Center, 2.3% of people have oligohydramnios. In the United States, 953 women in the third trimester over a 12-month period showed similar outcomes. Summertime saw a higher rating of oligohydramnios than the rest of the year.*

Objectives: *To compare the fetal renal artery Doppler in patients with or without oligohydramnios in third trimester.*

Methodology: *This is a case control study. This study includes the women in third trimester of pregnancy with oligohydramnios or normal liquor level and excludes the pregnant women with known maternal or fetal anomaly. Every expectant mother undergoing obstetrical US in the third trimester using a Toshiba Aplio Mx with a curvilinear transducer operating at 7–15 MHz, this study was done at Meer Khan children and family hospital, Lahore.*

Results: *Display the several parameters (PSV, EDV, RI, and PI) measured in the right fetal artery and classified as either normal or abnormal. Right fetal renal PSV, ED, RI, and PI were observed to differ significantly between the normal and oligo groups. PSV and PI did not differ significantly, however EDV ($p=0.017$) and RI ($p<0.001$) did. Significant differences between normal and oligo were observed in left fetal renal PSV, ED, RI, and PI. EDV, RI, and PI do not significantly differ between the groups. PSV showed a significant difference across groups ($p=0.015$).*

Conclusion: *Our study concluded that the RI of right renal artery and PI and PSV of left renal artery are elevated in oligohydramnios.*

Keywords: *Ultrasound, Pulsatility Index, Resistive Index, End diastolic value, Peak systolic value, Renal artery.*

INTRODUCTION

Oligohydramnios is a condition in pregnancy characterized by an abnormally low level of amniotic fluid the protective liquid that surrounds and cushions the fetus in the uterus[1]. Clinically, it is defined as when the deepest vertical pocket of amniotic fluid is less than 2 cm or when the amniotic fluid index (AFI) is below 5 cm during ultrasound examination[2]

Oligohydramnios affects roughly 1 to 5% of pregnancies at full term across the globe[3]. However, the numbers go up significantly over 12% when pregnancies go beyond their due date. In Africa, studies have shown even wider variations, with prevalence rates reported between 4% and 23%.[4]

This condition can occur due to a variety of reasons, including maternal dehydration, premature rupture of membranes, placental insufficiency or fetal anomalies affecting the kidneys or urinary tract.[5] The consequences of oligohydramnios can be fatal, especially if it develops early in pregnancy. Complications may include intrauterine growth restriction (IUGR), premature birth, umbilical cord compression, and increased chances of cesarean delivery[6]. It is linked to an elevated risk of adverse perinatal outcomes, including low birth weight and increased neonatal complication. [7]

Advancements in color Doppler ultrasonography have enabled detailed, non-invasive assessment of fetal renal circulation, providing valuable insights into fetal well-being. Beginning at approximately 22 weeks of gestation and continuing through 28 and 34 weeks, the pulsatility index (PI) and resistive index (RI) of the fetal renal arteries can be measured by analyzing three consecutive flow velocity waveforms at the arteries origin from the abdominal aorta[8]. In normal pregnancies, these indices typically remain within physiological ranges, correlating with adequate renal perfusion and normal amniotic fluid volume. However, in pregnancies complicated by oligohydramnios, PI and RI values are often elevated, reflecting increased renal vascular resistance. Notably, these hemodynamic alterations may precede clinically evident reductions in amniotic fluid volume, suggesting their potential utility as early indicators of compromised fetal renal perfusion. Serial Doppler evaluations of the renal arteries thus offer a valuable tool for monitoring at-risk pregnancies and may contribute to the timely identification and management of oligohydramnios-related complications.[9]

Although previous studies have linked oligohydramnios to pregnancy complications, there is still a lack of clear guidance on how to predict and manage these risks effectively. Research has shown increased chances of placental problems in future pregnancies and limited impact of diagnosis alone on improving outcomes, especially in low-resource[10]. This study aims to fill that gap by comparing fetal renal artery Doppler findings in women with and without oligohydramnios in the third trimester, which may help improve early detection of fetal compromise and guide better clinical decisions.

OBJECTIVE:

To compare the Doppler of renal artery in the pregnant women with or without oligohydramnios, to assess the changes due to oligohydramnios.

Methodology:

This is a case control study. This study was done at Meer Khan children and family hospital, Lahore. Simple and easy sampling techniques were used in the study. The sample size for this study was 100 patients. All pregnant women with the history of regular menstrual period and they all of them were scanned in the third trimester of pregnancy. Women with any known maternal or fetal pathology were excluded. Toshiba Xario XG ultrasound machine, convex probe frequency ranges (3MHZ-5MHZ) equipment was used in this study. Transabdominal scanning technique was used in this study. Every patient was asked to lie in supine position. A curvilinear 3-6 MHz probe with low dynamic range was used for the scan. First AFI was calculated through four-pockets method and after that renal arteries were evaluated on Doppler

RESULTS:

Right Fetal Renal Artery Doppler:

	OLIGO/NORMAL	N	Mean	Std. Deviation	Std. Error Mean	Sig.
RIGHT FETAL RENAL ARTERY - PSV	Normal	50	36.8740	12.84273	1.81624	.858
	Oligo	50	37.0222	12.17769	1.72219	
RIGHT FETAL RENAL ARTERY - EDV	Normal	50	6.9980	4.24949	.60097	.063
	Oligo	50	5.2800	2.63012	.37196	
RIGHT FETAL RENAL ARTERY - RI	Normal	50	.8582	.13642	.01929	.000
	Oligo	50	2.1310	1.55480	.21988	
RIGHT FETAL RENAL ARTERY - PI	Normal	50	1.9788	.58151	.08224	.344
	Oligo	50	2.1968	.72835	.10300	

TABLE 1: ThIs table compares Doppler indices of the right fetal renal artery between normal and oligohydramnios pregnancies, showing a statistically significant increase in Resistive Index (RI) (p = 0.000), while differences in PSV, EDV, and PI are not statistically significant.

Left Fetal Renal Artery Doppler:

	OLIGO/NORMAL	N	Mean	Std. Deviation	Std. Error Mean	Test of sig.
LEFT FETAL RENAL ARTERY - PI	Normal	50	2.4432	3.26984	.46243	.020
	Oligo	50	4.5092	8.10001	1.14551	
LEFT FETAL RENAL ARTERY - RI	Normal	50	2.5370	11.75726	1.66273	.061
	Oligo	50	.7426	.30797	.04355	
LEFT FETAL RENAL ARTERY - EDV	Normal	50	6.4700	2.28315	.32289	.141
	Oligo	50	5.8460	2.59546	.36705	
LEFT FETAL RENAL ARTERY - PSV	Normal	50	37.1500	11.44781	1.61896	.027
	Oligo	50	44.0814	16.14998	2.28395	

TABLE2: The table shows that in oligohydramnios pregnancies, the left fetal renal artery demonstrates significantly higher PI (p = 0.020) and PSV (p = 0.027), while RI and EDV differences are not statistically significant**.**

Discussion:

Our study demonstrated that the right fetal renal artery resistive index (RI) was significantly elevated in the oligohydramnios group compared to normal pregnancies, while peak systolic velocity (PSV) and pulsatility index (PI) showed

no significant differences. End-diastolic velocity (EDV) was lower in oligohydramnios, although the difference did not reach statistical significance. This pattern suggests increased vascular resistance in fetal renal circulation under low amniotic fluid conditions. Comparable findings were reported by Abdel Gaied et al., who observed higher PI values in fetal renal arteries in oligohydramnios pregnancies compared to normal cases[11]. Benzer et al. also found that both RI and PI were significantly raised in pregnancies complicated by oligohydramnios, suggesting a compensatory vascular response[9]. In a study by Jain et al., significantly elevated RI and PI values were reported in oligohydramnios, and these changes were associated with increased NICU admissions[12]. Laag et al. confirmed the diagnostic value of renal artery PI in differentiating oligohydramnios from normohydramnios using Doppler parameters[13]. Another study evaluating volume-corrected RA-PI found that this index was a robust predictor of oligohydramnios (ROC-AUC ≈ 0.84), whereas uncorrected or GA-adjusted RA-PI were less predictive[14].

These consistent findings across studies support our conclusion that RI is a more sensitive indicator of altered renal hemodynamics than PSV or PI alone. The elevation of RI in the oligohydramnios group may reflect early changes in renal perfusion and vascular tone, making it a valuable non-invasive tool in fetal surveillance.

In our dataset, oligohydramnios was associated with markedly higher mean Pulsatility Index (PI) (4.509 vs. 2.443, p = 0.020) and Peak Systolic Velocity (PSV) (44.08 vs. 37.15, p = 0.027) in the left fetal renal artery, while the Resistive Index (RI) was lower (0.743 vs. 2.537) but did not reach significance (p = 0.061); End Diastolic Velocity (EDV) was slightly reduced in oligohydramnios but non-significant (p = 0.141). These findings suggest increased renal vascular impedance and compensatory systolic flow in fetuses exposed to reduced amniotic fluid. Other prospective studies similarly report elevated renal PI and RI in oligohydramnios. Akin et al. found that both PI and RI were significantly increased in idiopathic oligohydramnios compared to normal pregnancies, with adverse perinatal outcomes more common in the oligohydramnios group[15]. In contrast, Karamanoglu et al. examined isolated oligohydramnios without fetal growth restriction and found no significant differences in renal artery PI or cerebroplacental ratio, implying that Doppler alterations may require additional fetal compromise to manifest (p for left PI = 0.353)[16].Post-term investigations, such as one by Baschat et al., showed that in pregnancies beyond 41 weeks, oligohydramnios correlated with elevated renal artery PI and reduced EDV, reinforcing the predictive value of Doppler in late-gestation fluid deficits[17]. Similarly, in prolonged pregnancies, Budunoglu et al. identified a strong negative correlation between amniotic fluid index and renal systolic/diastolic ratio ($r = -0.435$, $p < 0.01$), further supporting increased vascular resistance when fluid is low[18]. Our observation of significantly increased left-side PI and PSV aligns with these prior findings, emphasizing that renal resistance elevates earlier, potentially before fluid decline is sonographically detected. The lack of significant RI change in our cohort may reflect heterogeneous gestational timing. The consistent trend across studies toward elevated impedance markers confirms the utility of renal artery Doppler as an additional surveillance tool in pregnancies at risk for oligohydramnios. Routine measurement of both PI and PSV could enhance antenatal assessment in resource-limited settings or where advanced modalities are unavailable. Future larger, longitudinal studies should aim to establish gestational age–specific Doppler thresholds and clarify the relationship with perinatal outcomes.

Conclusion:

Our study concluded that the RI of right renal artery and PI and PSV of left renal artery are increased in oligohydramnios.

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