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NEONATAL OUTCOMES IN PATIENTS HAVING DERRANGED AMNIOTIC FLUID INDEX DURING PREGNANCY COMBINED MILITARY HOSPITAL, PESHAWAR

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ABSTRACT

Oligohydramnios with a reduced AFI and polyhydramnios with an increased AFI are associated with multiple perinatal risks in newborns, including IUGR, MAS, low Apgar scores, fetal death, and facial or skeletal abnormalities. Accordingly, the following research question has been developed for this current study: What are the common newborn complications in patients who have deranged AFI? An overall of 102 patients with singleton pregnancies with abnormal AFI after 4-quadrant ultrasound study were selected. Birth characteristics like early neonatal death, still birth, LGA, low apgar scores and NICU admission were noted. Consequently, the results showed that NICU admission was most frequent (37·2%), whereas low Apgar scores were 25·5%. The patients were aged 19 to 45 years with 29.37 ± 6.14 years, BMI of 18 to 29 kg/m² with 23.29 ± 2.58 and gestational age of 28 to 42 weeks with 38.47 ± 1.17. This study emphasizes the role of abnormal AFI volumes in fetal status recognition and aims at further investigation of this issue to decrease adverse neonatal results.

Keywords: *AFI, Oligohydramnios, polyhydramnios, perinatal mortality, NICU, low AGPAR score, neonatal mortality, still birth.*

INTRODUCTION

The amniotic fluid that surrounds the fetus is a very important part of normal intrauterine growth[1]. Amniotic fluid or fluid, the fluid surrounding the developing fetus, has multiple functions. The balance between the formation and reabsorption of this liquid must be maintained. Amniotic fluid volume changes during pregnancy. Oligohydramnios is a disease of reduced amniotic fluid, which is related to renal hypoplasia, placental dysfunction, congenital abnormalities, anemia, PIH, hypoxia, and other diseases. Its impact depends on the duration of pregnancy[2]. Amniotic fluid creates physical space for skeletal muscle growth, promotes normal lung development, and helps prevent umbilical cord compression[3]. Amniotic fluid volume is the result of the interaction between the mother and fetus' fluid balance; the fetal surface of the placenta and the fetal body surface come directly from the mother in the early pregnancy[4]. Fetal veins, pulmonary fluid secretion, fetal

swallowing, and intermembrane pathways contribute to the second half. Amniotic fluid volume varies with each week of pregnancy[5]. From 20 ml at 20 weeks to 270 ml at 28 weeks; stable at 39 weeks, then declines. The mean volume of amniotic fluid in the third trimester of pregnancy is 700,800 ml. Oligohydramnios is diagnosed when the AFI on ultrasound is <5cm, affecting 35% of pregnancies[6]. Oligohydramnios is associated with an increased frequency of maternal and fetal complications, namely fetal distress, meconium staining, and low Apgar of neonates and neonatal hospitalization and resuscitation[7]. The adverse outcomes are unique challenges to the obstetricians to manage in both oligohydramnios and polyhydromnias[8]. Polyhydramnios is also defined as having an amniotic fluid index of 24 cm or more, or the deepest pocket of more than 8 cm. Polydramnios can be caused by a variety of developmental abnormalities, both in the mother and in the placenta. Congenital birth defects, chromosomal aberrations, pregnancies, maternal diabetes, and Rh. Isoimmunization is one of them. None of these can be found in in about 65 percent of cases (idiopathic polyhydramnios)[9]. In patients presenting with deranged AFI, one study reported Fetal outcomes of 7.1 % stillbirths, 15% NICU admissions, 9% early neonatal deaths (ENND), and 75 % were in normal APGAR score range[10]. In third-world countries like Pakistan, the increased trend of neonatal mortality related to deranged AFI has a huge impact on the health system and all possible measures should be taken to reduce unnecessary neonatal deaths. The aim of the current study is to determine fetal outcomes related to deranged AFI so that it can be managed on time

MATERIALS AND METHODS

Study Area

The current study was carried out in the Department of Obstetrics and Gynecology in the Combined Military Hospital located in Peshawar city that is an authorized healthcare facility for women and infants. Military beneficiaries and other civilians are encountered in the obstetrics and neonatal care clinic of the hospital and; therefore, the model provides significant understanding of this field within the hospital.

Study Design

Descriptive study design was used for a snapshot survey of neonatal consequences of AFI derangement. The first aim was to evaluate the correlation between abnormally high/low AFI and various perinatal parameters using oligohydramnios and polyhydramnios cases.

Study Duration

This study was conducted for six months starting from 15th December 2022 to 15th June 2023 while reverting back eligible cases. The major advantage of this design was the time span granted the researchers to accrue adequate data and the subsequent follow up which enhanced the reliability and consistency of observing outcomes as the study reached its conclusion.

Sample Size

It was, therefore established that 102 patients would constitute the sample size for this study. This was done at a 10.2% prevalence of MAS in neonates born to mothers with oligohydramnios, at a 95% confidence level, a 5% margin of error as estimated from the WHO sample size estimation formula.

Sampling Methodology

Convenience nonprobability sampling technique was used where patients were recruited depending on the study inclusion criteria at their next clinic visits in the OPD. This technique helped minimize selection bias by capturing all the case during the study period.

Inclusion

Women with deranged AFI (either oligohydramnios or polyhydramnios).Age range: 15-45 years.Gestational age: 37-42 weeks estimated by Last Menstrual Period(LMP) or by ultrasound.
The pregnancy is a singleton and pregnancy diagnosis done by ultrasound.

Exclusion

Maternal disorders: Medical disorders: Multiple pregnancies (e.g., twins or triplets), malpresentation (e.g., breech, transverse). It includes fetal anomalies that occur within the womb, either stillbirth or death before delivery; ruptured membranes; placental abruption; hypertension in pregnancy; pre-eclampsia; eclampsia; and polyhydramnios.

Consent

The study was also done after receiving the approval of the hospital ethical and research committee with the consent of the patients. Participants were informed about the objectives of the study and the gains to be derived individually and in aggregate that the data being sought from them would be used solely for research and publishing.

Patient recruitment and follow up

A preliminary set of pregnant women with deranged AFI was selected using the inclusion criteria and invited to participate in the study in the OPD. All participants were followed up until delivery, in order to capture certain neonatal interventions, including early neonatal death, stillbirth, low Apgar scores, NICU admissions.

Data Collection

Information was collected in a structured manner by patients' interviews and examination. Every woman's name, age, parity, personal history and evaluation of findings has been documented on a format designed for the study. A study specialist in obstetrics, with a lowest of 5 years' functional experience was appointed to undertake the clinical observations and assessments.

Analysis

Data analysis was done using the statistical package of social sciences version 22; which is the most preferred software for medical research globally. This software offered a good means for analyzing both descriptive and inferential statistics. Means and standard deviations were computing through descriptive statistics, while percentages and proportions were computed through cros-tabulations and-summary chi-square tests were used in a post-stratification analysis. These statistical tools enabled definition of relationships between the variables under study and neonatal outcomes in particular.

RESULTS

These included factors relevant to gestational age at birth, mode of delivery, AFI abnormalities, congenital malformations and maternal characteristics. Contrary to clinical wisdom that gestational age underlies early neonatal death and stillbirth, no positive correlation between gestational age and early neonatal death or stillbirth was identified. Ασμό Costa et al's findings point some type of evidence towards maternal health and neonatal care offer as merely impacting the gestational age. Likewise, the choice of delivery, that is, V or CS did not influence the neonatal outcomes could be attributed to the emerging neonatal resuscitation and care. The two severe forms of amniotic fluid abnormalities, namely oligohydramnios and polyhydramnios were also not significantly associated with neonatal mortality, and it is possibly and probably due to the severity of AFI derangement. Whereas, congenital anomalies were found to have strong relationship with early neonatal mortality, meaning prompt diagnosis and management should be to prevent high mortalities according to results of this finding. It is important to note that the large majority of participants in the study were less than 35 years old, and were likely to be healthy before getting pregnant, which would explain the otherwise good neonatal outcome across the study. A comparison of separate neonatal outcomes based on key variables including maternal age, gestational age, and congenital anomalies assist in the identification of important predictors of neonatal morbidity and mortality. These observations underscore the need for intervention to be focused on pregnant women at risk to improve the survival rate of the new born

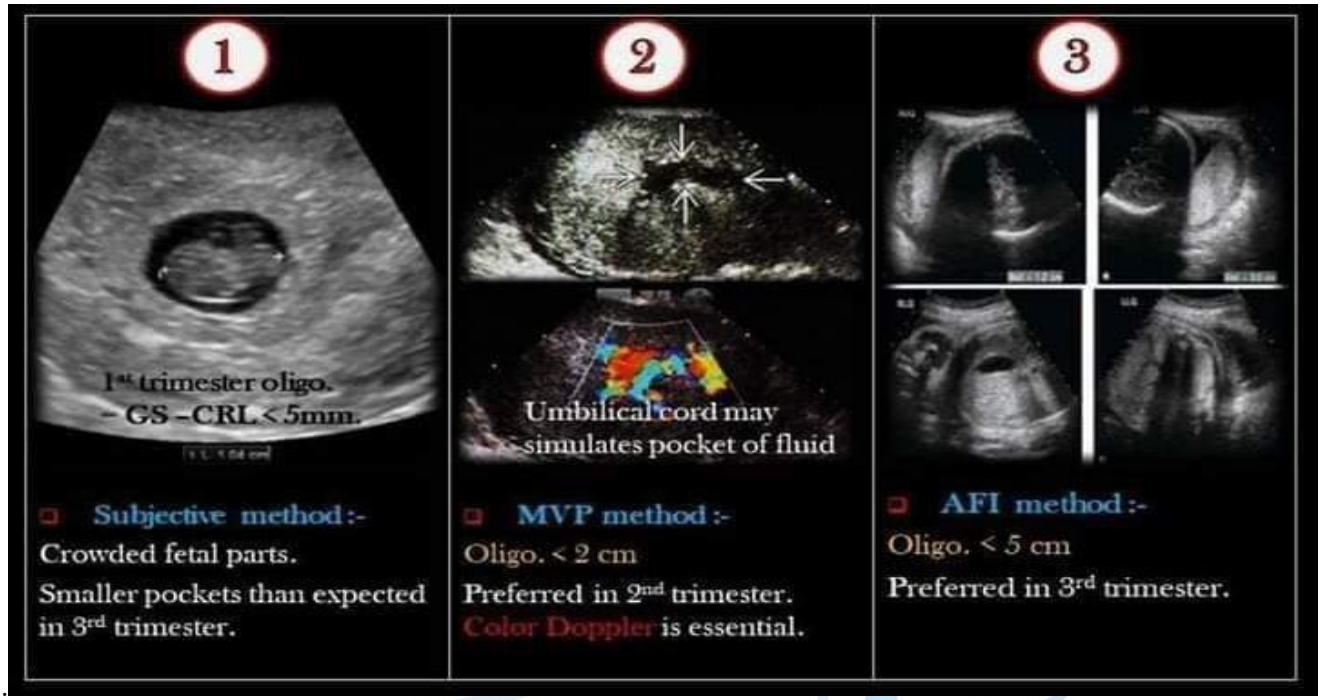


Figure. Ultrasound image of Oligohydramnios

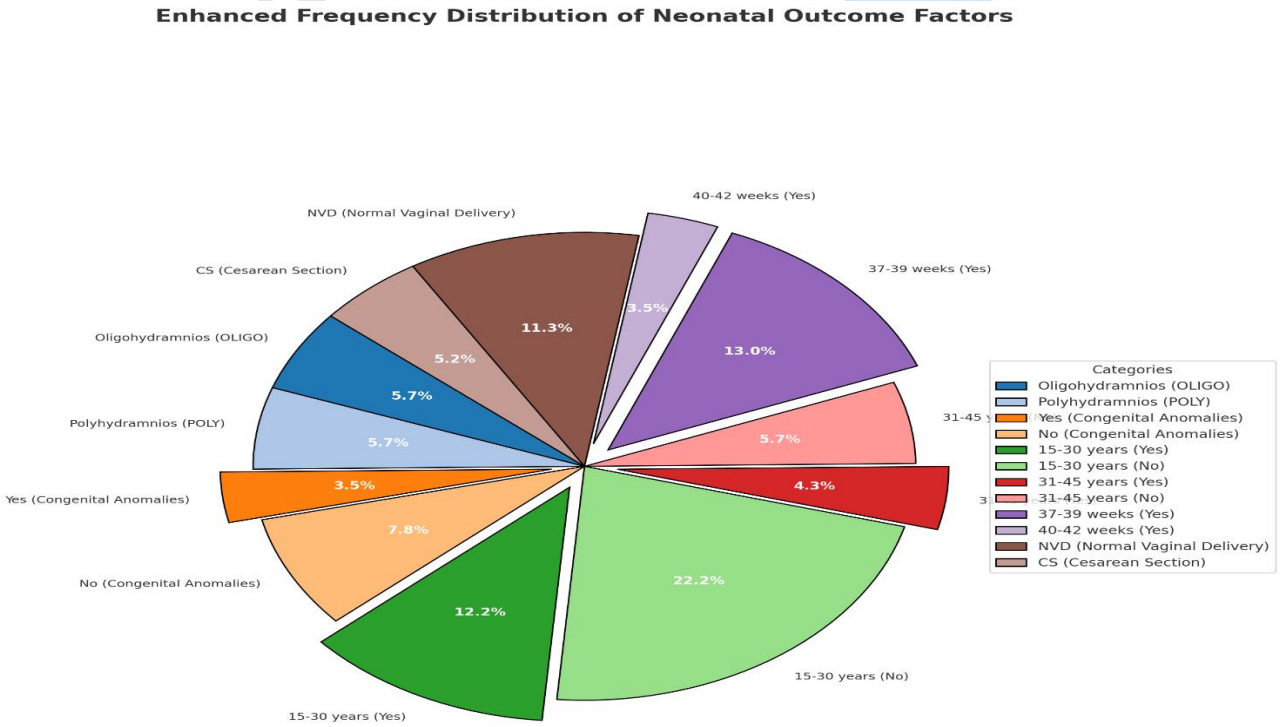


Table 1Demographics, Baseline Characteristics, and Perinatal Outcomes in Patients with Deranged Amniotic Fluid Index Department of Obstetrics and Gynecology, at the Combined Military Hospital, Peshawar,

Characteristic	Subcategory	Frequency (n)	Percentage (%)	p-value
Demographics and Baseline Characteristics	Patient Age (years)	102	-	-
	Mean ± SD	29.37 ± 6.143	-	-
	Gestational Age (weeks)	102	-	-
	Mean ± SD	38.47 ± 1.171	-	-
	BMI (Kg/m²)	102	-	-
	Mean ± SD	23.285 ± 2.5843	-	-
Age Distribution	15-30 years	79	77.4%	-
	31-45 years	23	22.6%	-
	Total	102	100%	-
Gestational Age	37-39 weeks	70	68.6%	-
	40-42 weeks	32	31.4%	-
	Total	102	100%	-
Mode of Delivery	NVD (Normal Vaginal Delivery)	70	68.6%	-
	CS (Cesarean Section)	32	31.4%	-
	Total	102	100%	-
Type of Deranged AFI	Oligohydramnios (Low AFI)	54	52.9%	-
	Polyhydramnios (High AFI)	48	47.1%	-
	Total	102	100%	-
Congenital Anomalies	Yes	14	13.7%	-
	No	88	86.3%	-
	Total	102	100%	-
Perinatal Outcomes	Early Neonatal Death	12	11.7%	-
	No Early Neonatal Death	90	88.3%	-
	Stillbirth	14	13.7%	-
	No Stillbirth	88	86.3%	-
	Low APGAR Score	26	25.5%	-
	Normal APGAR Score	76	74.5%	-
	NICU Admission	38	37.2%	-
	No NICU Admission	64	62.8%	-
Stratification: Age and Early Neonatal Death	15-30 years (Yes)	9	11.4%	0.828
	15-30 years (No)	70	88.6%	-
	31-45 years (Yes)	3	13.0%	-
	31-45 years (No)	20	87.0%	-
	Total (Yes)	12	11.7%	-
	Total (No)	90	88.3%	-
Stratification: Gestational Age and	37-39 weeks (Yes)	7	10.0%	0.413

Early Neonatal Death				
	37-39 weeks (No)	63	90.0%	-
	40-42 weeks (Yes)	5	15.6%	-
	40-42 weeks (No)	27	84.4%	-
	Total (Yes)	12	11.7%	-
	Total (No)	90	88.3%	-
Stratification: Mode of Delivery and Early Neonatal Death	NVD (Yes)	8	7.8%	0.876
	NVD (No)	62	92.2%	-
	CS (Yes)	4	12.5%	-
	CS (No)	28	87.5%	-
	Total (Yes)	12	11.7%	-
	Total (No)	90	88.3%	-

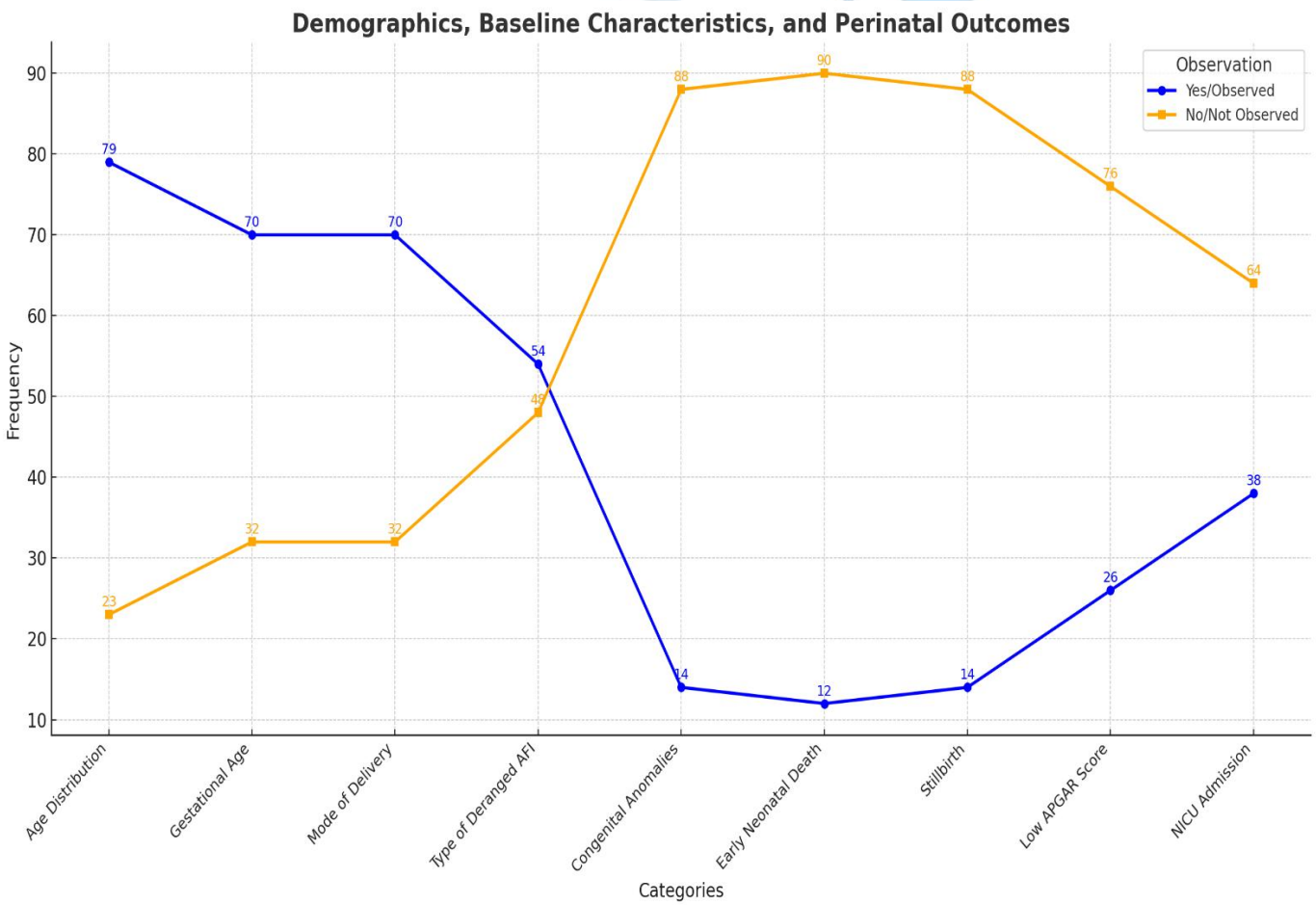
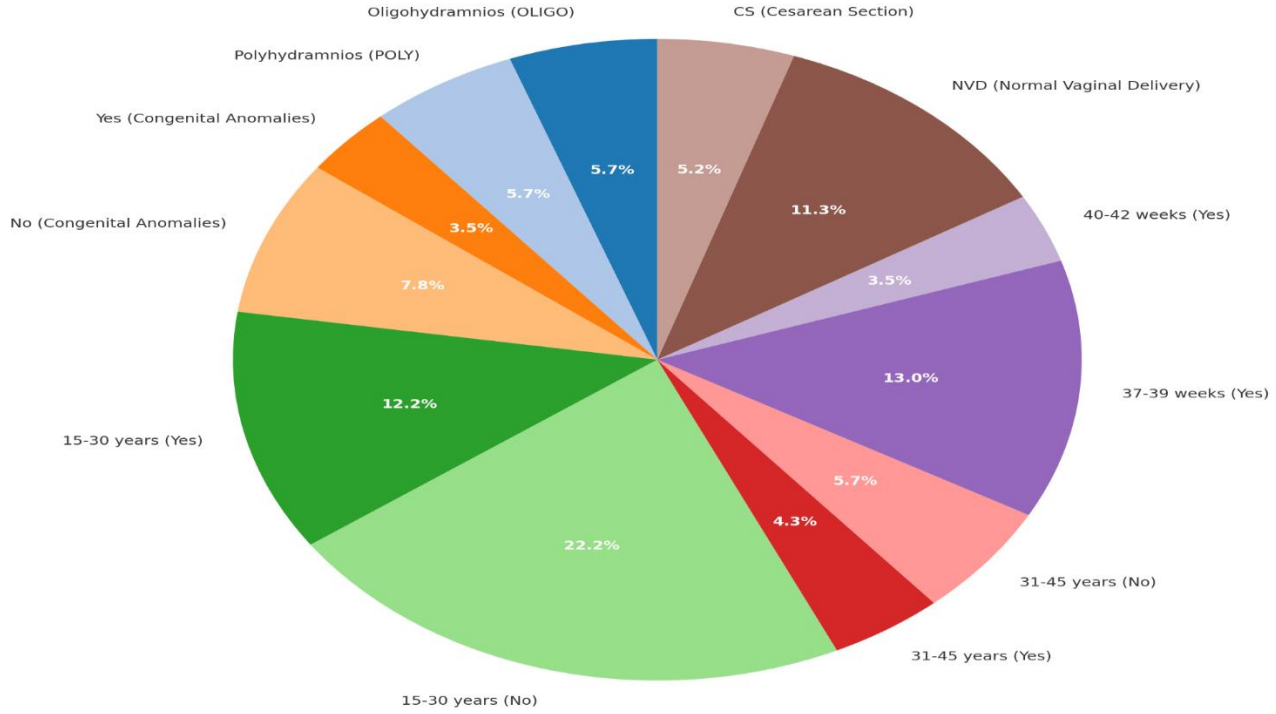


Table 2 Stratified Neonatal Outcomes in Patients with Deranged Amniotic Fluid Index: Impact of Type of Derangement, Congenital Anomalies, and Maternal Factors Department of Obstetrics and Gynecology, at the Combined Military Hospital, Peshawar,

Characteristic	Subcategory	Frequency (n)	Percentage (%)	p-value
Stratification: Type of Derangement and Early Neonatal Death	Oligohydramnios (OLIGO)	06	11.1%	0.827
	Polyhydramnios (POLY)	06	16.7%	-
	Total	12	11.7%	-
Stratification: Congenital Anomalies and Early Neonatal Death	Yes (Congenital Anomalies)	08	57.1%	<0.001
	No (Congenital Anomalies)	04	4.5%	-
	Total	12	11.7%	-
Stratification: Age and Stillbirth	15-30 years (Yes)	09	11.4%	0.204
	15-30 years (No)	70	88.6%	-
	31-45 years (Yes)	05	21.7%	-
	31-45 years (No)	18	78.3%	-
	Total (Yes)	14	13.7%	-
	Total (No)	88	86.3%	-
Stratification: Gestational Age and Stillbirth	37-39 weeks (Yes)	09	12.8%	0.706
	40-42 weeks (Yes)	05	15.6%	-
	Total (Yes)	14	13.7%	-
	Total (No)	88	86.3%	-
Stratification: Mode of Delivery and Stillbirth	NVD (Normal Vaginal Delivery)	10	14.3%	0.807
	CS (Cesarean Section)	04	12.5%	-
	Total (Yes)	14	13.7%	-
	Total (No)	88	86.3%	-
Stratification: Type of Derangement and Stillbirth	Oligohydramnios (OLIGO)	08	14.8%	0.734
	Polyhydramnios (POLY)	06	16.7%	-
	Total (Yes)	14	13.7%	-
	Total (No)	88	86.3%	-
Stratification: Congenital Anomalies and Stillbirth	Yes (Congenital Anomalies)	08	57.1%	<0.001
	No (Congenital Anomalies)	06	6.8%	-
	Total (Yes)	14	13.7%	-
	Total (No)	88	86.3%	-
Stratification: Age and Low APGAR Score	15-30 years (Yes)	16	20.2%	0.024
	15-30 years (No)	63	79.8%	-
	31-45 years (Yes)	10	43.5%	-
	31-45 years (No)	13	56.5%	-
	Total (Yes)	26	25.5%	-
	Total (No)	76	74.5%	-
Stratification: Gestational Age and Low APGAR	37-39 weeks (Yes)	14	-	-
	40-42 weeks (Yes)	12	-	-
	Total (Yes)	-	-	-
	Total (No)	-	-	-


Frequency Distribution of Factors Influencing Neonatal Outcomes
Oligohydramnios (OLIGO)
CS (Cesarean Section)
Polyhydramnios (POLY)
NVD (Normal Vaginal Delivery)
Yes (Congenital Anomalies)
40-42 weeks (Yes)
No (Congenital Anomalies)
37-39 weeks (Yes)
15-30 years (Yes)
31-45 years (No)
31-45 years (Yes)
15-30 years (No)
5.7%
5.2%
11.3%
5.7%
3.5%
3.5%
7.8%
13.0%
12.2%
5.7%
4.3%
22.2%

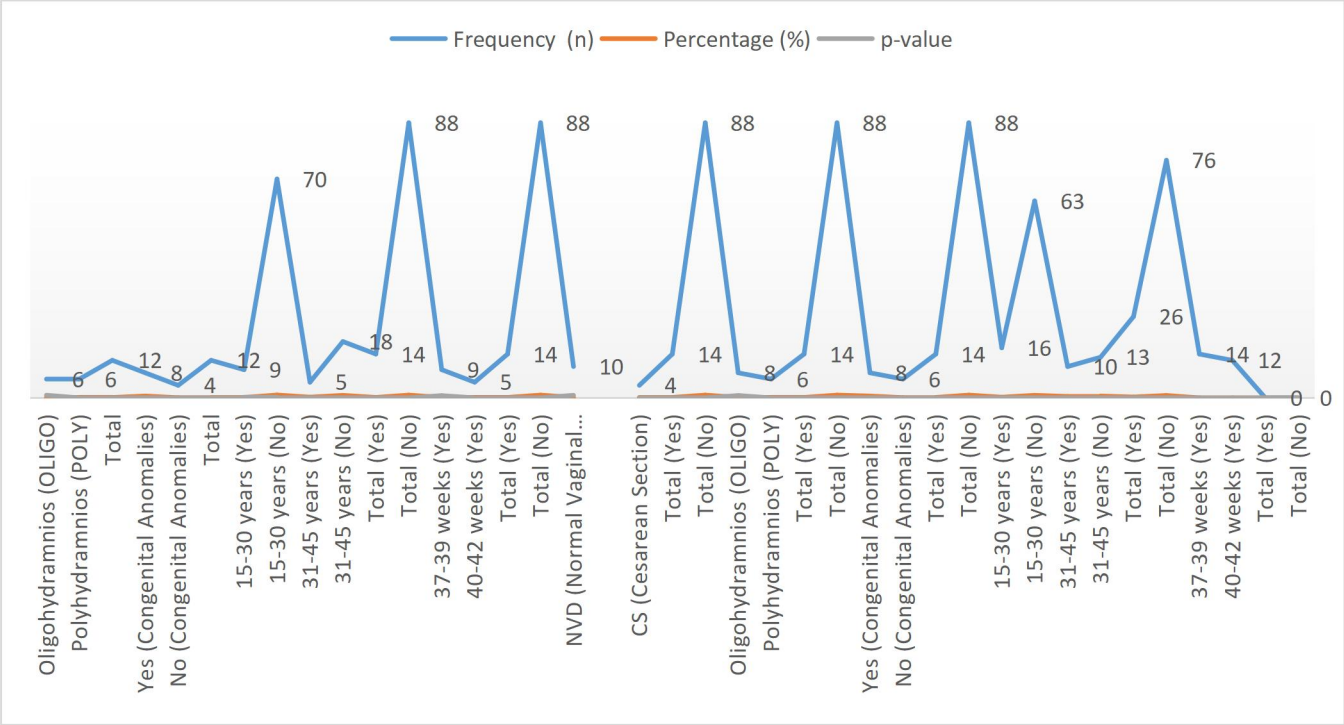
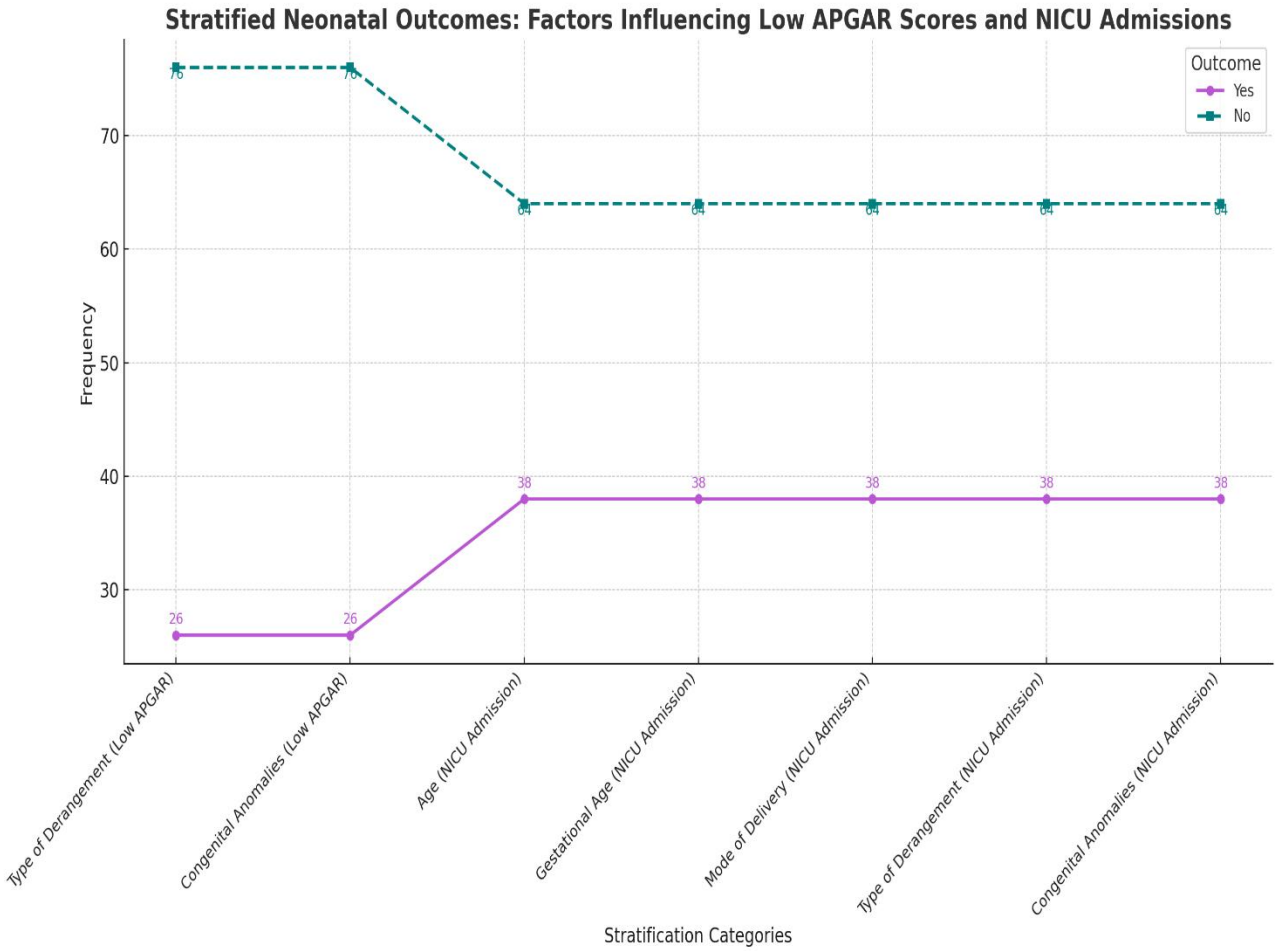

Frequency (n)
Percentage (%)
p-value
Oligohydramnios (OLIGO)
Polyhydramnios (POLY)
Total
Yes (Congenital Anomalies)
No (Congenital Anomalies)
Total
15-30 years (Yes)
15-30 years (No)
31-45 years (Yes)
31-45 years (No)
Total (Yes)
Total (No)
37-39 weeks (Yes)
40-42 weeks (Yes)
Total (Yes)
Total (No)
NVD (Normal Vaginal...
CS (Cesarean Section)
Total (Yes)
Total (No)
Oligohydramnios (OLIGO)
Polyhydramnios (POLY)
Total (Yes)
Total (No)
Yes (Congenital Anomalies)
No (Congenital Anomalies)
Total (Yes)
Total (No)
15-30 years (Yes)
15-30 years (No)
31-45 years (Yes)
31-45 years (No)
Total (Yes)
Total (No)
37-39 weeks (Yes)
40-42 weeks (Yes)
Total (Yes)
Total (No)

Table 3 Stratified Neonatal Outcomes: Factors Influencing Low APGAR Scores and NICU Admissions in Patients with Deranged Amniotic Fluid Index Department of Obstetrics and Gynecology, at the Combined Military Hospital, Peshawar

Characteristic	Subcategory	Frequency (n)	Percentage (%)	P-value
Stratification: Type of Derangement and Low APGAR	Oligohydramnios (OLIGO)	13	24.1%	0.727
	Polyhydramnios (POLY)	13	27.0%	-
	Total (Yes)	26	25.5%	-
	Total (No)	76	74.5%	-
Stratification: Congenital Anomalies and Low APGAR	Yes (Congenital Anomalies)	08	57.1%	0.003
	No (Congenital Anomalies)	18	20.5%	-
	Total (Yes)	26	25.5%	-
	Total (No)	76	74.5%	-
Stratification: Age and NICU Admission	15-30 years (Yes)	28	20.2%	0.483
	15-30 years (No)	51	79.8%	-
	31-45 years (Yes)	10	43.5%	-
	31-45 years (No)	13	56.5%	-
	Total (Yes)	38	37.2%	-
	Total (No)	64	62.8%	-
Stratification: Gestational Age and NICU Admission	37-39 weeks (Yes)	30	42.8%	0.083
	40-42 weeks (Yes)	08	25.0%	-
	Total (Yes)	38	37.2%	-
	Total (No)	64	62.8%	-
Stratification: Mode of Delivery and NICU Admission	NVD (Normal Vaginal Delivery)	26	37.1%	0.927
	CS (Cesarean Section)	12	37.5%	-
	Total (Yes)	38	37.2%	-
	Total (No)	64	62.8%	-
Stratification: Type of Derangement and NICU Admission	Oligohydramnios (OLIGO)	19	35.2%	0.646
	Polyhydramnios (POLY)	19	39.6%	-
	Total (Yes)	38	37.2%	-
	Total (No)	64	62.8%	-
Stratification: Congenital Anomalies and NICU Admission	Yes (Congenital Anomalies)	08	57.1%	0.097
	No (Congenital Anomalies)	30	20.5%	-
	Total (Yes)	38	37.2%	-
	Total (No)	64	62.8%	-



Discussion

Clinical evaluation of amniotic fluid volume has been employed for more than 30 years for predicting adverse neonatal outcomes; and actual and sonographically estimated amniotic fluid volumes correlate well (155). A recent study also revealed that mildly abnormal sonographic amniotic fluid estimates had no effect on the adverse pregnancy outcomes as concluded in 101 and another study mentioned the absence of poorly related adverse outcomes when oligohydramnios was isolated without the presence of other complications as can be deduced from 99. Magann et al further noted that in a prior prospective analysis they failed to reveal an association between the actual and sonographic AFV and adverse neonatal outcome (103). The sample analysis shows that there is an urgent and essential requirement to moving the risk stratification of amniotic fluid volume in a way that optimises outcomes without creating an avoidable addition to silico intervention. One large, retrospective study conducted in 2005 identified tendencies of the associations between abnormalities in amniotic fluid and adverse outcomes, whereas specific abnormalities are still unknown and they pointed to a possibility that the increased risk might be characteristic of substantial rather than minor deviations from the norm. Liu et al showed that combined increased SDP and AFI values impose greater risks than elevated SVT alone and that the contemporary values used to identify high or low SDP and AFI may not be sufficiently(writer 75). Literature on oligohydramnios is often combined with PPROM, and low fluid volumes are associated with dangers of neonatal sepsis and death (47). Severe oligohydramnios, defined as AFI <3 cm in PPROM, significantly increases risks of low APGAR scores, neonatal sepsis, early neonatal mortality (100), NICU stays and lower birth weight infants had significantly higher prevalence of extremely low volumes ofAFW. AFI correlated with the actual volume and was more accurate than other methods because

oligohydramnios is already known to have increased risk for adverse outcomes in pregnancy (21). The high-risk pregnancies with oligohydramnios had higher adverse outcome rate compared to normal AFV in similar conditions but differences were very small and statistically non-significant as found in Zhang et al (104). Magann et al. failed to demonstrate any difference in complications of women with HELLP syndrome delivering high-risk neonates when compared with those with AFI ≤5 cm and women with AFI >5 cm (103), while Barrilleaux and Magann suggested that AFI can be a weak predictor of fetal compromise in women with HELLP syndrome (103). It is therefore possible that optimal management of pregnancies with oligohydramnios may not require expediting delivery especially for women without fetal distress since adverse outcomes may be more closely related to high-risk conditions than to a low AFV. It was agreed by Voxman that the severity of oligohydramnios does not mean that the neonate will experience adverse health outcomes, especially if they received aggressive treatment (12). Morris recommended that AFI is superior to single deepest pool measurement after forty weeks, however, AFI has crude sensitivity concerning adverse pregnancy outcomes, constant use of USG at term may boost the intervention rates even if it does not enhance the results. 101.

CONCLUSION

Naming of the state of amniotic fluid can still be an important contributing factor in evaluating the state of the fetus and remain an important facet of obstetrics. Since AFV assessment is a routine part of sonographic practice, we need to better define what represents low or high amniotic fluid. This study was designed to add to this knowledge by dividing pregnancies into normal and high risk with further subdivision of the latter by levels of AFV. As would be expected, the women in the study population with at risk pregnancies with abnormal fluid levels had higher perinatal risk scores. Specifically, the number of NICU admissions was higher in these cases, which underscores the importance of ongoing appraisal and modification of the rules for using fluid volume as an indicator for intervention in a patient's situation and management.

REFERENCES

Beall MH, van den Wijngaard JP, van Gemert MJ, Ross MG. Amniotic fluid water dynamics. Placenta 2007; 28: 816–23.

Magann EF, Sandlin AT, Ounpraseuth ST. Amniotic fluid and the clinical relevance of the sonographically estimated amniotic fluid volume: oligohydramnios. J Ultrasound Med 2011; 30: 1573–85.

Brace RA. Amniotic fluid volume and its relationship to fetal fluid balance: review of experimental data. Semin Perinatol 1986; 10: 103–12.

Gillibrand PN. Changes in the electrolytes, urea, and osmolality of the amniotic fluid with advancing pregnancy. J Obstet Gynaecol Br Commonw 1969; 76: 898–905.

Lee SM, Park SK, Shim SS, Jun JK, Park JS, Syn HC. Measurement of fetal urine production by three_dimensional ultrasonography in normal pregnancy. Ultrasound Obstet Gynecol 2007; 30: 281–86.

Peixoto_Filho FM, de Sa RA, Velarde LG, Lopes LM, Ville Y. Normal range for fetal urine production rate by 3–D ultrasound in a Brazilian population. Arch Gynecol Obstet 2011; 283: 497–500.

Modena AB, Fieni S. Amniotic fluid dynamics. Acta Biomed 2004; 75 Supplement 1: 11–13.

Pritchard JA. Deglutition by Normal and Anencephalic Fetuses. Obstet Gynecol 1965; 25: 289–97.

Tomoda S, Brace RA, Longo LD. Amniotic fluid volume and fetal swallowing rate in sheep. Am J Physiol 1985; 249: R133–38.

Brace RA, Anderson DF, Cheung CY. Fetal swallowing as a protective mechanism against oligohydramnios and polyhydramnios in late gestation sheep. Reprod Sci 2013; 20 (3): 326–30.

Minei LJ, Suzuki K. Role of fetal deglutition and micturition in the production and turnover of amniotic fluid in the monkey. Obstet Gynecol 1976; 48: 177–81.

Brace RA, Wlodek ME, Cock ML, Harding R. Swallowing of lung liquid and amniotic fluid by the ovine fetus under normoxic and hypoxic conditions. Am J Obstet Gynecol 1994; 171: 764–70.

Assali NS. Pathophysiology of gestation. New York: Academic Press; 1972.

Fischer C, Rybakowski C, Ferdynus C, Sagot P, Gouyon JB. A Population‐Based Study of Meconium Aspiration Syndrome in Neonates Born between 37 and 43 Weeks of Gestation. Int J Pediatr 2012; 2012: 321545.

Balchin I, Whittaker JC, Lamont RF, Steer PJ. Maternal and fetal characteristics associated with meconium‐stained amniotic fluid. Obstet Gynecol 2011; 117: 828–35.

Bolisetty S, Patole SK, McBride GA, Whitehall JS. Neonatal amniotic fluid aspiration syndrome underdiagnosed? Int J Clin Pract 2001; 55: 727–28.

Ikeda N, Yamakawa M, Imai Y, Suzuki T. Sudden infant death from atelectasis due to amniotic fluid aspiration. Am J Forensic Med Pathol 1989; 10: 340–43.

Beall MH, van den Wijngaard JP, van Gemert MJ, Ross MG. Regulation of amniotic fluid volume. Placenta 2007; 28: 824–32.

Zhang Y, Ding S, Shen Q, Wu J, Zhu X. The expression and regulation of aquaporins in the placenta and fetal membranes. Front Biosci 2012; 17: 2371–82.

Jiang SS, Zhu XJ, Ding SD, Jiang LL, Jiang WX, Zhu XQ. Expression and localization of Aquaporins 8 and 9 in term placenta with oligohydramnios. Reprod Sci 2012; 19(12):1276–84.

Damiano AE. Review: Water channel proteins in the human placenta and fetal membranes. Placenta 2011; 32 Supplement 2: S207–11.

Mann SE, Nijland MJ, Ross MG. Mathematic modeling of human amniotic fluid dynamics. Am J Obstet, and two‐diameter pocket in normal human pregnancy. Am J Obstet Gynecol 2000; 182: 1581–88.

Shanks A, Tuuli M, Schaecher C, Odibo AO, Rampersad R. Assessing the optimal definition of oligohydramnios associated with adverse neonatal outcomes. J Ultrasound Med 2011; 30: 303–07.

Schwartz N, Sweeting R, Young BK. Practice patterns in the management of isolated oligohydramnios: a survey of perinatologists. J Matern Fetal Neonatal Med 2009; 22: 357–61.

Munn MB. Management of oligohydramnios in pregnancy. Obstet Gynecol Clin North Am 2011; 38: 387–95.

O'Neill E, Thorp J. Antepartum evaluation of the fetus and fetal well being. Clin Obstet Gynecol 2012; 55: 722–30.

RANZCOG. Maternal suitability for models of care, and indications for referral within and between models of care (C‐Obs 30). 2012.

Practice Bulletin No AC. 107: Induction of labor. Obstet Gynecol 2009; 114: 386– 97.

ACOG practice bulletin. Antepartum fetal surveillance. Number 9, October 1999 (replaces Technical Bulletin Number 188, January 1994). Clinical management guidelines for obstetrician‐gynecologists. Int J Gynaecol Obstet 2000; 68: 175–85.

Liston R, Sawchuck D, Young D. Fetal health surveillance: antepartum and intrapartum consensus guideline. J Obstet Gynaecol Can 2007; 29: S3–56.

Magann EF, Morton ML, Nolan TE, Martin JN Jr, Whitworth NS, Morrison JC. Comparative efficacy of two sonographic measurements for the detection of aberrations in the amniotic fluid volume and the effect of amniotic fluid volume on pregnancy outcome. Obstet Gynecol 1994; 83: 959–62.

Phelan JP, Ahn MO, Smith CV, Rutherford SE, Anderson E. Amniotic fluid index measurements during pregnancy. J Reprod Med 1987; 32: 601–04.

Brady K, Polzin WJ, Kopelman JN, Read JA. Risk of chromosomal abnormalities in patients with idiopathic polyhydramnios. Obstet Gynecol 1992; 79: 234–38.

Phelan JP, Park YW, Ahn MO, Rutherford SE. Polyhydramnios and perinatal outcome. J Perinatol 1990; 10: 347–50.

Magann EF, Doherty DA, Lutgendorf MA, Magann MI, Chauhan SP, Morrison JC. Peripartum outcomes of high‐risk pregnancies complicated by oligo‐ and polyhydramnios: a prospective longitudinal study. J Obstet Gynaecol Res 2010; 36: 268–77.

Ott WJ. Reevaluation of the relationship between amniotic fluid volume and perinatal outcome. Am J Obstet Gynecol 2005; 192: 1803–9; discussion 9.

Rochelson B, Wagner J, Shmoys S. The clinical significance of resolving polyhydramnios. Ultrasound Obstet Gynecol 1992; 2: 321–24.

Leibovitch L, Schushan_Eisen I, Kuint J, Weissmann_Brenner A, Maayan _Metzger A. Short_term outcome for term and near_term singleton infants with intrapartum polyhydramnios. Neonatology 2012; 101: 61–67.
Abele H, Starz S, Hoopmann M, Yazdi B, Rall K, Kagan KO. Idiopathic Polyhydramnios and Postnatal Abnormalities. Fetal Diagn Ther 2012; 32 (4): 251–5.
Perović M, Garalejić E, Gojnić M, Arsić B, Pantić I, Bojović DJ, et al. Sensitivity and specificity of ultrasonography as a screening tool for gestational diabetes mellitus. J Matern Fetal Neonatal Med 2012; 25: 1348–53.
Idris N, Wong SF, Thomae M, Gardener G, McIntyre DH. Influence of polyhydramnios on perinatal outcome in pregestational diabetic pregnancies. Ultrasound Obstet Gynecol 2010; 36: 338–43.
Barnhard Y, Bar_Hava I, Divon MY. Is polyhydramnios in an ultrasonographically normal fetus an indication for genetic evaluation? Am J Obstet Gynecol 1995; 173: 1523–27.
Magann EF, Whitworth NS, Bass JD, Chauhan SP, Martin JN Jr, Morrison JC. Amniotic fluid volume of third_trimester diamniotic twin pregnancies. Obstet Gynecol 1995; 85: 957–60.
Morin L, Lim K. Ultrasound in twin pregnancies. J Obstet Gynaecol Can 2011; 33: 643–56.
Magann EF, Doherty DA, Ennen CS, Chauhan SP, Shields D, Gjesdal SM, Morrison JC. The ultrasound estimation of amniotic fluid volume in diamniotic twin pregnancies and prediction of peripartum outcomes. Am J Obstet Gynecol 2007; 196: 570 e1–6; discussion e6–8.
Hernandez JS, Twickler DM, McIntire DD, Dashe JS. Hydramnios in twin gestations. Obstet Gynecol 2012; 120: 759–65.
Stein RG, Diessner J, Frieauff E, Zollner U, Rehn M, Dietl J, Hönig A. Acute fetal_fetal transfusion syndrome–case report and review of the literature. Z Geburtshilfe Neonatol 2012; 216: 147–49.
Shveiky D, Ezra Y, Schenker JG, Rojansky N. Monoamniotic twins: an update on antenatal diagnosis and treatment. J Matern Fetal Neonatal Med 2004; 16: 180–86.
Simpson LL. Twin_twin transfusion syndrome. Am J Obstet Gynecol 2013; 208: 3–18.
Huber A, Diehl W, Zikulnig L, Bregenzer T, Hackeloer BJ, Hecher K. Perinatal outcome in monochorionic twin pregnancies complicated by amniotic fluid discordance without severe twin - twin transfusion syndrome. Ultrasound Obstet Gynecol 2006; 27: 48–52.
Moise KY, Kugler L, Jones T. Contemporary management of complicated monochorionic twins. J Obstet Gynecol Neonatal Nurs 2012; 41: 434–44, quiz 45–46.
Carver A, Haeri S, Moldenhauer J, Wolfe HM, Goodnight W. Monochorionic diamniotic twin pregnancy: timing and duration of sonographic surveillance for detection of twin - twin transfusion syndrome. J Ultrasound Med 2011; 30: 297–301.
Su LL. Monoamniotic twins: diagnosis and management. Acta Obstet Gynecol Scand 2002; 81: 995–1000.
Inde Y, Miyake H, Takaya A, Ono S, Igarashi M, Suzuki S. A case of monochorionic - diamniotic twin pregnancy with polyhydramnios_polyhydramnios sequence. J Nippon Med Sch 2009; 76: 93–95.

PROFORMA

Patient Information

Field	Details/Options
Case No:	_____
Date:	//_____
Patient's Name:	_____
Reg. No.:	_____
Address:	_____
G P:	_____
Age:	_____ years
Period of Gestation:	_____ months

Amount of Amniotic Fluid:	_____ ml

Assessment Details

Field	Options
1. Amount of Amniotic Fluid (AFI in cm):	☐ AFI < 5 cm ☐ AFI > 25 cm
2. Fetal Anomaly Present:	☐ Yes ☐ No
3. Mode of Delivery:	☐ Normal Vaginal Delivery (NVD) ☐ LSCS ☐ Instrumental Delivery
4. Neonatal Condition at Birth:	
- 1 min Apgar Score > 7/10:	☐ Yes ☐ No
- 1 min Apgar Score < 7/10:	☐ Yes ☐ No
- Presence of Meconium:	☐ Yes ☐ No
- Needs NICU Admission:	☐ Yes ☐ No