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# Amniotic Fluid Volume Disorders: Causes and Effects

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**Abstract- Background:** Amniotic fluid is the protective liquid contained by the amniotic sac of a gravid uterus. It is necessary for human fetal growth and development. The amniotic fluid volume (AFV) depends on the gestational age. AFV can be altered in various abnormal situations and may lead to many adverse perinatal outcomes.

**Methods:** A retrospective observational study was done on the admitted patients of Maternal Fetal Medicine Unit, Department of Obs and Gynae, Dhaka Medical College Hospital, Bangladesh, during the year 2020. With due permission from department of obs and Gynae and ethical clearance from appropriate committee, records of admitted patients with abnormal amniotic fluid volume were reviewed and analyzed for evaluation of their underlying etiologies and subsequent outcome of these pregnancies.

**Results:** Among total 656 admitted patients 130 (19.8%) had oligohydramnios and 27 (4.1%) had polyhydramnios. 76.9% of oligohydramnios was due to prelabour rupture of membrane. Other associated conditions of oligohydramnios were hypertensive disorders of pregnancy and growth restricted fetus (11.5%), Diabetic disorders (10.0%), Anomalous fetus (8.5%) and undetermined causes (2.3%). Polyhydramnios was mainly associated with fetal anomaly (59.3%) but a little percentage was associated with gestational diabetes (14.8%), multiple pregnancies (11.1%), chorioangioma (3.7%) and undetermined (11.1%) causes.

**Keywords:** amniotic fluid, ployhydramnios, oligohydramnios, perinatal outcome, dhaka medical college hospital.

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# Amniotic Fluid Volume Disorders: Causes and Effects

Sultana MT<sup>α</sup>, Laila A<sup>σ</sup> & Nasrin UT<sup>ρ</sup>

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**Discussion:** From the current study and also other studies showed that some abnormalities of pregnancy are almost always present with amniotic fluid volume disorders and subsequently lead to a considerable number of adverse perinatal outcomes.

**Conclusion:** It is important to keep an eye on amniotic fluid index for better pregnancy outcome.

**Keywords:** amniotic fluid, ployhydramnios, oligohydramnios, perinatal outcome, dhaka medical college hospital.

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## 1. INTRODUCTION

Amniotic fluid is a clear, yellow fluid which is found within the first 12 days following conception within the amniotic sac. It surrounds the growing baby in the uterus<sup>1</sup>. It is colorless with slight to moderate turbidity. Amniotic fluid is necessary for human fetal growth and development. The fluid volume cushions the fetus, protecting it from mechanical trauma. Its bacteriostatic properties may help to maintain a sterile intrauterine environment. The space created by the amniotic fluid allows fetal movement and aids in the normal development of both the lungs and the limbs<sup>2,3</sup>.

The rate of amniotic fluid production depends on the gestational age. It produced at a rate of 10 mL/week at first trimester, 50-60 mL/week from 19-25 weeks of gestation, so it increases progressively between 10 to 30 weeks of gestation. It measures about <10 mL at 8 weeks, 50 mL at 12 weeks, 400 mL at 20 weeks, 770 mL at 28 weeks, 1 L at 36-38 weeks. But after 36 weeks, volume decreases at a rate of 60 mL/week at 40 weeks gestation, so it measures 600-800 mL at 40 weeks and subsequently 33% decline in volume per week<sup>3</sup>.

Ultrasound is a safe method to estimate the AFV. A number of techniques to measure AFV are used. First method is to measure Maximum Vertical Pocket (MVP) depth. It refers to the vertical dimension of the largest pocket of amniotic fluid not containing umbilical cord or fetal extremities and measured at a right angle in the uterine surface. Oligohydramnios is considered if the depth of MVP < 2 cm and Polyhydramnios is considered if the MVP depth is ≥ 8 cm. The second method is to measure Amniotic Fluid Index (AFI). It is calculated by first dividing the surface markings of the uterus into four quadrants using the linea nigra and umbilicus. The maximum vertical amniotic fluid pocket diameter in each quadrant not containing cord or fetal extremities is measured in centimeters and then the sum of these measurements constitutes the AFI. Oligohydramnios is labeled when AFI is ≤ 5 cm and Polyhydramnios is labeled when AFI ≥ 24 cm. The assessment of AFV in twin pregnancies is especially important, given their high perinatal mortality rate. The MVP technique seems to be the most appropriate in twins, using the same definitions that are used in singletons. The use of the AFI in twins has poor inter-

and intra observer variability, and therefore should not be used in clinical practice<sup>4,5,6</sup>.

Oligohydramnios, occur in 4% of all pregnancies and 12% of post-date pregnancies<sup>1</sup>. This may be evident in cases of leaking fluid from a tear in the amniotic membranes, measuring small in volume for a certain stage of pregnancy by ultrasonography or if the fetus is not moving as much as it would be expected to. It can also be occurs in mothers with a history of any of the medical conditions, like prior growth-restricted pregnancies, Hypertensive disorders in pregnancy, Problems with the placenta, (for example, abruption), Diabetic disorders in pregnancy, SLE and other autoimmune conditions, Multiple pregnancies (for example twins or triplets), Birth defects, such as kidney abnormalities, Delivering past the due date and other unknown reasons, known as idiopathic.<sup>1,7,8</sup>

According to the American Pregnancy Association, polyhydramnios can be occurs in 1% of all pregnancies<sup>1</sup>. Fetal disorders that can lead to polyhydramnios include gastrointestinal disorders (duodenal or esophageal atresia, gastroschisis, and diaphragmatic hernia), Brain or nervous system disorders (anencephaly or myotonic dystrophy), Achondroplasia, Fetal heart rate problems, Infection, Beckwith-Wiedemann syndrome, Fetal lung abnormalities, Hydrops fetalis, Twin-to-Twin Transfusion syndrome and Rh incompatibility or Kell diseases. Poorly controlled maternal diabetes also increases the risk. Too much fluid can also be produced during multiple pregnancies<sup>3</sup>.

Polyhydramnios causes maternal symptoms like abdominal pain and difficulty breathing due to the enlargement of the uterus. Other complications include preterm labour, premature rupture of membranes, placental abruption, stillbirth, postpartum hemorrhage, fetal malposition, cord prolapsed<sup>3</sup>.

Amniotic fluid volume disorders can happen during any trimester but is more evident during second

and third trimesters. During that time, there is a higher risk for loss of pregnancy, preterm birth, or neonatal loss of life<sup>4</sup>. Associated birth defects are mostly the cause of abnormal amniotic fluid volume and also responsible for adverse perinatal outcome<sup>3,9</sup>.

## II. METHODS

A retrospective observational study was done in the Maternal-Fetal medicine (MFM) unit of Obs and Gynae Department, Dhaka Medical College Hospital, Bangladesh. After taking permission from hospital authority and Obgyn department, the patient's records from January to December 2020 were retrieved. Permission from Ethical review board was taken for publishing the data (Ref. Memo No. ERC – DMC/ECC/2021/422). From records of all admitted patients of MFM unit, the women who had abnormal amniotic fluid volume were sorted out. Two types of amniotic volume abnormalities were separated and analyzed. Oligohydramnios was defined when AFI is  $\leq 5$  cm and Polyhydramnios was defined when AFI  $\geq 24$  cm. in case of multiple pregnancy MVP measurement was considered along with AFI. Patient's anthropometric data, previous medical status and current pregnancy complications along with perinatal outcomes were put on SPSS (version 16). Analysis was done by using frequency and percentage for categorical data and mean $\pm$ SD for quantitative variables. Data was presented as charts and diagrams for better understanding.

## III. RESULTS

During the year of 2020 total 656 patients were admitted in Maternal-Fetal Medicine unit of Obs and Gynae department, Dhaka Medical College and Hospital, Bangladesh. Among them 130 (19.8%) patients were diagnosed as having oligohydramnios in their current pregnancy and 27(4.1%) patients were diagnosed as having polyhydramnios (Fig 1).

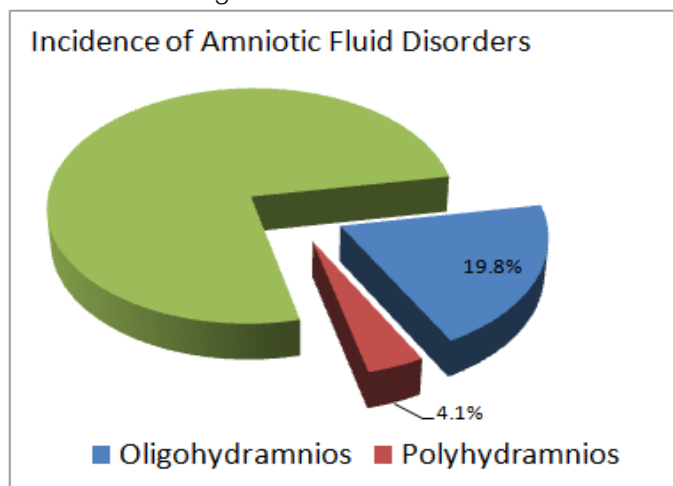
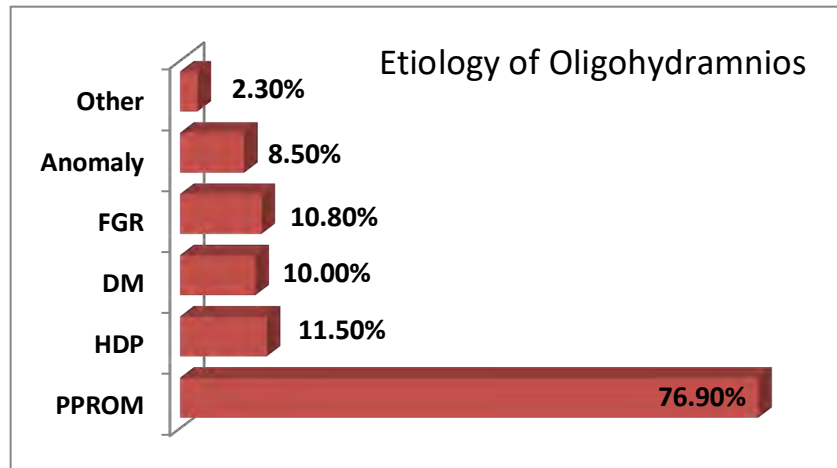


Fig. 1: Incidence of Amniotic Fluid Volume Abnormalities Among High Risk Patients

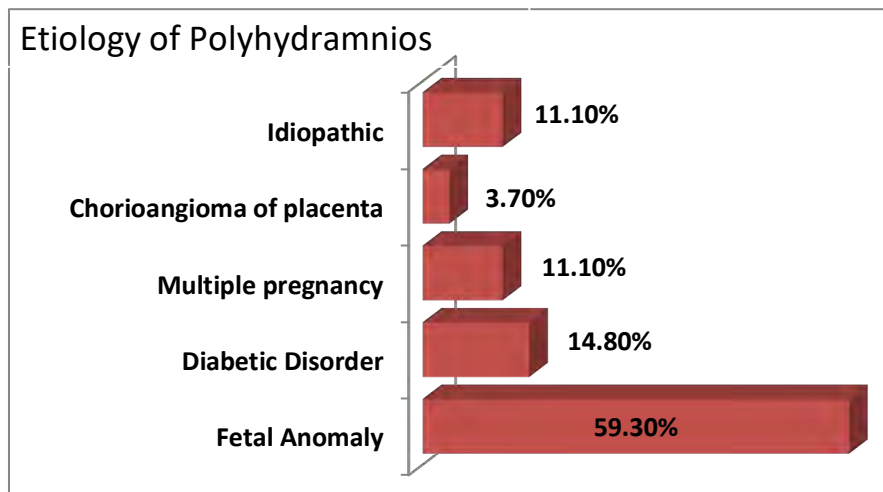
The mean age of our patients having polyhydramnios were  $24.71 \pm 4.39$  years. All patients oligohydramnios was  $25.99 \pm 5.11$  years and were of south-east Asian origin.



*Fig. 2:* Associated Problems with Oligohydramnios (There Were Some Overlapping Conditions So the Total Percentage was Not Exactly 100%)

Most of the oligohydramnios (76%) were due to preterm prelabor rupture of membrane. Other associated conditions of oligohydramnios were hypertensive disorders of pregnancy and growth

restricted fetus (11.5%), Diabetic disorders (10.0%), Anomalous fetus (8.5%) and undetermined causes (2.3%).



*Fig. 3:* Associated Problems with Polyhydramnios

Polyhydramnios was mainly associated with fetal anomaly (59.3%) but a little percentage was associated with gestational diabetes (14.8%), multiple pregnancies (11.1%), chorioangioma (3.7%) and undetermined (11.1%) causes.

Out of 130 oligohydramnios patients 83 were delivered in our hospital and the rest were taken discharge in undelivered state. The mean gestational age of delivery was  $31.3 \pm 2.73$  weeks. Among them 63 (75.9%) babies were born alive and 20 (24.1%) were still birth. 29 (34.93%) of the live babies needed admission in NICU and 9 (10.84%) of the admitted babies died during their neonatal period.

The total number of polyhydramnios patients 27 and 20 patients were delivered in our hospital. The mean gestational age of delivery was  $32.0 \pm 4.29$  weeks. Among them 10 (50.00%) babies were born alive and 10 (50.00%) were still birth. 5 (25.00%) of the live babies needed admission in NICU and 4 (20.00%) of the admitted babies died during their neonatal period.

#### IV. DISCUSSION

Dhaka Medical College Hospital (DMCH) is the largest tertiary hospital of Bangladesh which is fully supported by government. High risk pregnancy patients came here from all over the country and got admitted in

Maternal Fetal medicine unit of Department of Obs and Gynae, for better management.

In this study the total number of admitted patient under Maternal Fetal Medicine unit of ObGyn department DMCH were 656 in the year 2020. Out of them 130 (19.8%) patients were diagnosed as having oligohydramnios and 27(4.1%) patients having polyhydramnios in their current pregnancy. Bakhsh et al found incidence of oligohydramnios 11.7% and polyhydramnios 2.8% in a secondary care hospital of Saudi Arabia<sup>6</sup>. As our hospital is a tertiary center and the current study was conducted in a high risk pregnancy unit so incidences are higher in our study.

The mean age of our patients having oligohydramnios was  $25.99 \pm 5.11$  years and polyhydramnios were  $24.71 \pm 4.39$  years. All patients were of south-east Asian origin.

Most of the oligohydramnios (76%) were due to preterm prelabor rupture of membrane. Other associated conditions of oligohydramnios were hypertensive disorders of pregnancy and growth restricted fetus (11.5%), Diabetic disorders (10.0%), Anomalous fetus (8.5%) and undetermined causes (2.3%). Bakhsh et al showed 13.7% Diabetic Disorders, 5.2% fetal anomaly but no hypertensive disorders among oligohydramnios patient<sup>6</sup>. Lavanya B et al found 24% hypertensive patients and 15% of growth restricted fetus with oligohydramnios<sup>7</sup>. The inclusion of prelabor rupture of membrane in our study may be the most influential factor for making etiological difference from other studies.

Polyhydramnios was mainly associated with fetal anomaly (59.3%) but a considerable percentage was associated with gestational diabetes (14.8%), multiple pregnancies (11.1%), chorioangioma (3.7%) and undetermined (11.1%) causes. Bakhsh et al showed 42.9% diabetic disorder, 7.1% hypertensive disorders, 14.2% fetal anomaly among polyhydramniotic patients<sup>6</sup>. Abele et al found 40% of the polyhydramnios cases as idiopathic<sup>10</sup>. The percent of idiopathic in our study was found less may be caused by advancement of investigation facilities.

Out of 130 oligohydramnios patients 83 were delivered in our hospital and the rest were taken discharge in undelivered state. The mean gestational age of delivery was  $31.3 \pm 2.73$  weeks. Among them 63 (75.9%) babies were born alive and 20(24.1%) were still birth. 29 (34.93%) of the live babies needed admission in NICU and 9 (10.84%) of the admitted babies died during their neonatal period. Bakhsh et al showed 24.1% NICU admission of babies among oligohydramnios pregnancies<sup>6</sup>. Lavanya B et al found that 45% of baby needed NICU admission after delivery from an oligohydramniotic condition. Lavanya B et al also found 10% still birth and 2% neonatal death among patients with oligohydramnios<sup>7</sup>. So we have found a significant percent of hospital admission in all studies.

The total number of polyhydramnios patients 27 and 20 patients were delivered in our hospital. The mean gestational age of delivery was  $32.0 \pm 4.29$  weeks. Among them 10 (50.00%) babies were born alive and 10 (50.00%) were still birth. 5 (25.00%) of the live babies needed admission in NICU and 4 (20.00%) of the admitted babies died during their neonatal period. Bakhsh et al showed 35.7% of babies from polyhydramnios pregnancy as NICU admission. So polyhydramnios is a major factor for adverse perinatal outcome. This may be due to the strong association of anomaly babies and diabetic mothers.

## V. CONCLUSION

To identify pregnancies with risk of poor perinatal outcomes, AFI measurement can be used as one of the important method. Ultrasound evaluation of abnormal amniotic fluid volume indicates a wide range of pregnancy complications and can predict adverse perinatal outcome for that pregnancies.

*Recommendations for future research:*

- To conduct large study in a more precise way so that the rare etiologies come in front.
- Long term outcome of babies should be followed to evaluate the consequences.

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