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A Study on Perinatal Outcome in Term Oligohydramnios

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Abstract: ***Background:*** *Amniotic fluid acts like a protection wall for fetus and also provides essential nutrients to fetus. Oligohydramnios, that is too little amniotic fluid, is associated with high rate of maternal and perinatal morbidity and mortality. Amniotic fluid index assessed antepartum help inidentifying women who need increased antenatal surveillance for pregnancycomplication.*

Objective of the study: *To assess and compare the perinatal outcome in AFI <5 cm (oligohydramnios) and AFI ≥5 cm (control group) in term pregnancies.*

Materials and Methods: *A total of 100 patients admitted in obstetrics emergency ward were grouped as cases (AFI <5 cm; n=50) and controls (AFI ≥5 cm; n=50). Inclusion criteria included single live intrauterine gestation with cephalic presentation, 37 completed weeks of gestation and intract membrane. Various outcomes recorded were induced versus spontaneous labour, nature of amniotic fluid, non-stress test, mode of delivery, indication of caesarean section or instrumental delivery, Apgar score at 1 minute and 5 minutes, birth weight, admission to neonatal ward, perinatal morbidity and mortality. Babies were followed till 7 days after birth.*

Results: *The induced labour, non-reactive NST, caesarean section rate due to fetal distress, Still birth, Neonatal death, low birth weight and NICU admission were significantly high among those with AFI<5cm than those with AFI≥5cm.*

Conclusion: *Oligohydramnios is associated with increased pregnancy interventions in the form of induction of labour and caesarean delivery, intrauterine deaths and non-reactive fetal heart. There is also an increased neonatal morbidity and perinatal mortality.*

Keywords: *Amniotic fluid, Oligohydramnios, fetal distress, Neonatal death, NICU*

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I. Introduction

Oligohydramnios is defined as deficiency of amniotic fluid which at term is less than 200ml or amniotic fluid index <5cm. About 8-10% of pregnant women can have low levels of amniotic fluid, with about 5% being diagnosed with oligohydramnios.[1] It is associated with high rate of pregnancy complications, congential anomalies and perinatal morbidity and mortality.[2] Amniotic fluid covers the fetus everywhere and helps fetal development. It has a number of prominent functions like protection of the fetus from trauma, maintenance of body temperature, development of lungs and musculoskeletal system by permitting fetal movements, growth and development of intestinal tract by swallowing amniotic fluid and also provides essential nutrients to fetus.[3] It reduces the potential for infection through its bacteriostatic properties and protects fetus and umbilical cord from compressive forces.[4]

Amniotic fluid is a clear, slightly yellowish liquid which is contained in the amniotic sac. The fluid is faintly alkaline with low specific gravity of 1.010. An osmolarity of 250 mosmol/litre is suggestive of fetal maturity. In early pregnancy, it is colourless but near term it becomes pale straw coloured due to the presence of exfoliated lanugo and epidermal cells from fetal skin.[5]

The amount of amniotic fluid present at any one time reflects a balance between amniotic fluid production and removal. Hence, maintenance of amniotic fluid is a dynamic process, with different contributing

factors at different stages of pregnancy. The six potential pathways for fluid movement into and out of the amniotic cavity include fetal urine, fetal swallowing, oral secretions, secretions from respiratory tract, transfer across the placenta, umbilical cord and fetal skin (intramembranous flow) and across the fetal membranes (transmembranous flow).

Amniotic fluid is present since gestational sac is formed. Swallowed amniotic fluid is reabsorbed by the gastrointestinal tract and then recirculated through the kidneys. The exponential rise in amniotic fluid after 8-11 weeks of gestation suggests that the initiation of urine production begins in first trimester.

By 18 weeks, fetus excretes an estimated urine volume of 7 ml-14 ml per 24 hours, while swallowing accounts for 4 ml-11 ml per 24 hours. In third trimester, fetal swallowing and urination strongly influence the constitution and volume of amniotic fluid. The intramembranous pathway includes passive exchange that occurs across fetal skin, umbilical cord and fetal surface of placenta. Fluid is also absorbed through fetal tissues and skin after 22-25 weeks of gestation but when fetal skin is keratinised, the fluid is primarily absorbed by fetal gut. The equilibrium between fetus, fetal plasma and amniotic fluid is secondary to diffusion across the skin.

Estimation of amniotic fluid volume is an integral part of antenatal surveillance.[6] Amniotic fluid index (AFI) is calculated as the sum of deepest vertical dimension in four quadrants of the uterus.[7] Normal amount of amniotic fluid is the largest vertical fluid pocket measuring between 2 and 8 cm.[8] AFI is a more objective and reproducible method as it estimates the amniotic fluid in 4 quadrants of uterus and AFI less than 5 cm is diagnosed as oligohydramnios. An AFI of 5-24 cm is considered normal.[9] Use of AFI rather than single largest pocket identifies more pregnancies having oligohydramnios. In general, oligohydramnios developing early in pregnancy is less common, frequently associated with congenital anomalies and has a poor prognosis.[10]

Oligohydramnios may be associated with uteroplacental insufficiency, idiopathic fetal growth restriction (IUGR), premature rupture of fetal membrane, fetal hypoxia, low apgar scores, congenital abnormalities, meconium stained liquor and post maturity syndrome.[11] Oligohydramnios can also be an idiopathic finding in the woman who had low risk pregnancies and no medical or fetal complications.[12] Sequel of oligohydramnios can be fetal demise, pulmonary hypoplasia, facial and skeletal deformities. Reduced amniotic fluid may predispose to umbilical cord occlusion and increase the risk of fetal hypoxemia and may affect the apgar score of baby at birth.[13] Low Apgar score describes cardio- respiratory and neurological depression of new born.[14]

Potter face is the atypical physical appearance of a baby due to oligohydramnios. It has been observed that antepartum or intra partum AFI < 5cm is associated with a significant increase in risk of lower segment caesarean section for fetal distress and low apgar score at 5 minute (Apgar score <5).[15] Patients with AFI < 5cm should be admitted to hospital.[16] The reduction of amniotic fluid is associated with increase in induction of labour, stillbirth, non-reassuring fetal heart rate pattern, meconium aspiration syndrome and neonatal death.

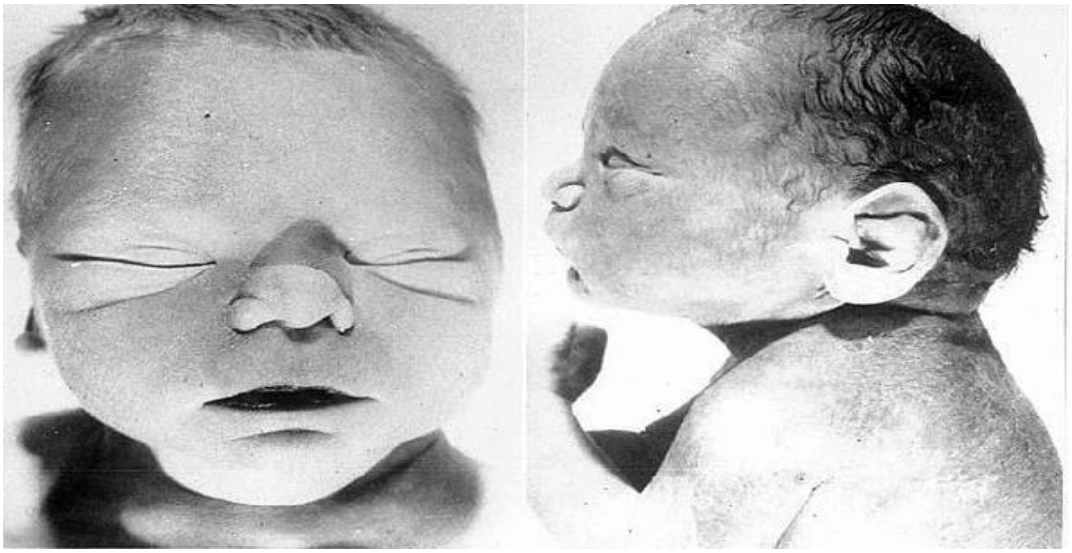

Fig: Potter Face

AFI assessed antepartum help in identifying women who need increased antenatal surveillance for pregnancy complication. Women with oligohydramnios usually have low birth weight babies but can expect safe and good outcome for which proper fetal surveillance and regular antenatal care visits are required. Maternal causes of oligohydramnios are postdated pregnancy, preterm premature rupture of membranes, infections, hypertension, autoimmune disorder and maternal medication like prostaglandin synthetase inhibitors.

Fetal causes of oligohydramnios are fetal growth (intrauterine growth restriction) and fetal anomalies, particularly of renal tract. Commonly associated renal anomalies with oligohydramnios include bilateral renal agenesis, multicystic dysplastic kidney, bladder outlet obstruction and infantile polycystic kidney disease. Placental causes include placental abruption, placental thrombosis and infarction, uteroplacental insufficiency and twin-twin transfusionsyndrome.

The present study was undertaken to assess and compare the perinatal outcome in AFI <5 cm (oligohydramnios) and AFI ≥5 cm (control group) in term pregnancies.

II. Materials And Methods

The present observational study was conducted on a total of 100 patients admitted in obstetrics emergency ward of Department of Obstetrics and Gynaecology, SMGS Hospital, Government Medical College, Jammu for a period of one year after approval from the institutional ethics committee. Patients were grouped as cases (n=50) and controls (n=50). All patients with AFI <5 cm were grouped as cases and those with AFI ≥5 cm as controls.

Inclusion criteria included single live intrauterine gestation with cephalic presentation, 37 completed weeks of gestation and intract membrane. Patients excluded were those with gestational age <37 completed weeks, post-term delivery, associated fetal malformations, ruptured membrane, malpresentation/multiple gestation, with previous caesarean, myomectomy and hysterotomy.

Detailed history of the patient was recorded in each case, alongwith chief complaints, detailed obstetrical/menstrual history and medical history. A complete physical and systemic examination was done. Obstetrical examination was done, which included period of gestation, fundal height, fundal, lateral and pelvic grips and auscultation of fetal heart sound. Routine laboratory investigations included Hb, BT, CT, ABO/Rh, urine analysis.

Assessment of amniotic fluid volume

Ultrasonography of each patient was done in the Department of Radiodiagnosis by sonologist with the use of 3.5-5 MHz linear or sector transducer on real time grey scale sonographic scanner by 4 quadrant technique. Following details were recorded – biparietal diameter, femur length, fetal cardiac activity andAFI.

Step by step technique for determining the AFI

- Position of patient issupine.
- A linear, curvilinear or sector transducer probe 3.5MHz can beused.
- Divide uterus into 4 quadrants using the maternal sagittal midline vertically and the arbitrary transverse line approximately half way between the symphysis pubis and upper edge of uterinefundus.
- The transducer mustbe kept parallel to the material sagittal plane and perpendicular to the maternal coronal planethroughout.
- The deepest, unobstructed and clear pockets of amniotic fluid, without limb bud or cord structures is visualized and the image frozen. The ultrasound calipers are manipulated to measure the pocket in a strictly vertical direction.

The process is repeated in each 4 quadrant and the pocket measurements summed AFI.

Oligohydramnios was defined as amniotic fluid index <5 cm, while normal amniotic fluid index was taken between 5 and 24 cm.

Patients were grouped according to their AFI, as cases with AFI< 5cm and control group with AFI ≥5cm. The patients were followed up by observing the mode of delivery, if delivery was by caesarean section the indication were recorded. The condition of babies was assessed by birth weight, Apgar score, colour of liquor, need and indication for neonatal admission.

Various outcomes recorded were induced versus spontaneous labour, nature of amniotic fluid, non-stress test, mode of delivery, indication of caesarean section or instrumental delivery, Apgar score at 1 minute and 5 minutes, birth weight, admission to neonatal ward, perinatal morbidity and mortality. Babies were followed till 7 days after birth.

The data was analyzed using computer software Microsoft Excel and SPSS version 21.0 for Windows. Data was reported as mean ± standard deviation and proportions as deemed appropriate for quantitative and qualitative variables respectively. The statistical difference in mean value between two groups was tested using unpaired 't' test. The qualitative data was compared using Fisher's exact test. A p-value of <0.05 was considered as statistically significance. All p-values reported were two-tailed.

III. Results

To evaluate the perinatal outcome in term oligohydramnios (AFI <5 cm) and to compare the outcome with those who had AFI ≥5 cm, the patients were followed from the day of admission till 7 days after delivery. Mean ± standard deviation of AFI in cases was significantly less as compared to that of controls (3.45 ± 1.17 vs 14.18 ± 1.94; p<0.0001) (Table 1).

Majority of patients in cases and controls were in the age group of 21 to 30 years (88% vs 80%; p=0.34) (Table 2). Similarly, most patients were primigravida in cases (72%) as well as in control (54%), the difference being statistically not significant (p=0.09) (Table3).

In cases, gestational age at delivery was 37 weeks in 42% patients, 38 weeks in 28% patients and 39 weeks in 30% patients, while in controls, gestational age at delivery was 37 weeks in 22% patients, 38 weeks in 24% patients, 39 weeks in 46% patients and 40 weeks in 8% patients. The difference in mean gestational age between the groups was statistically significant (38.33 ± 0.96 vs 38.81 ± 0.92; p=0.01) (Table 4).

In cases, non-stress test (NST) was non-reactive in 42% of patients, while in controls, it was in 18% patients, the difference being statistically significant (p=0.01) (Table 5).

Mode of onset of labour in cases was induced in 76%, while in controls it was 22%, the difference being significant (p<0.0001) (Table 6).

In cases, 44% had normal delivery, while caesarean section was done in 56%, of which 38% had caesarean section for fetal distress. In control group, caesarean section was done in 28% patients, of which 6% had caesarean section for fetal distress. The difference between the two groups was statistically significant (p=0.008) (Table 7).

Meconium was observed in 56% patients in cases as compared to 20% in controls, the difference again being statistically significant (p=0.0004) (Table 8).

There were more babies with birth weight <2.5 kg (56%) in cases as compared to those in controls (4%). Statistically, the difference was significant (p<0.0001). Mean birth weight of babies in cases was 2.33 ± 0.48 kg compared to 2.90 ± 0.38 kg in controls, the difference being statistically significant (p<0.0001) (Table 9).

In cases, at 1 minute Apgar score was <7 in 32% babies as compared to 4% in controls, the difference being statistically significant (0.0004). However, at 5 minutes Apgar score was <7 in 8% babies as compared to 2% in controls, the difference being not significant (p=0.36). Mean Apgar score at 5 minutes was also similar in both the groups (9.56 ± 1.68 vs 9.92 ± 0.56; p=0.15) (Table10)

NICU admission was significantly more in cases as compared to controls (20% vs 2%; p=0.007). Respiratory distress was more in cases as compared to controls (6% vs 2%; p=0.61). Similarly, meconium aspiration was observed in 4% of neonates in cases whereas it was not observed in any neonate in control group, the difference being statistically not significant (p=0.49) (Table11).

Still birth and neonatal death were observed in 2% and 4% babies in cases, while there was no mortality in controls. Statistically, there was no significant difference in these parameters (p>0.05) (Table12).

After 7 days of follow-up, 76% babies were healthy in cases. In remaining 12 (24%), more than one morbid condition was present. Jaundice was observed in 4% babies with one having IUGR. One low birth weight baby had IUGR. Respiratory distress syndrome was observed in 2% babies. There were 3 perinatal deaths – 1 (2%) still birth and 2 (4%) neonatal deaths. In controls, 49 (98%) were healthy babies, while 1 (2%) had respiratory distress syndrome (Table13).

Table 1: Mean values of amniotic fluid index (AFI) in cases and controls

Groups	Amniotic Fluid Index (AFI)	
	Mean ± Standard deviation (cm)	Statistical inference (unpaired t test)
Cases (n=50)	3.45 ± 1.17	**t=33.49; p<0.0001; Highly significant**
Controls (n=50)	**14.18 ± 1.94**	

Table 2: Distribution of patients according to age in cases and controls

Age group (in years)	Cases (n=50) No. (%)	Controls (n=50) No. (%)
≤20	3 (6.00)	**5 (10.00)**
21 – 25	28 (56.00)	**20 (40.00)**
26 – 30	16 (32.00)	**20(40.00)**
>30	3 (6.00)	**5 (10.00)**
Total	**50**	**50**
Mean age ± Standard deviation (in years)	**25.16 ± 3.61**	**25.86 ± 3.71**
Statistical inference (unpaired t test)	**t=0.95; p=0.34; Not significant**	

Table 3: Distribution of patients according to gravidity in cases and controls

Gravidity	Cases (n=50) No. (%)	Controls (n=50) No. (%)	Statistical inference (Fisher's exact test)
Primigravida	36 (72.00)	27 (54.00)	**p=0.09; Not significant**
Gravida 2	7 (14.00)	12 (24.00)	
Gravida 3	5 (10.00)	8 (16.00)	
Gravida 4 and above	2 (4.00)	3 (6.00)	
Total	**50**	**50**	

Table 4: Distribution of patients according to gestational age at delivery in cases and controls

Gestational age at delivery (weeks)	Cases (n=50) No. (%)	Controls (n=50) No. (%)
37	21 (42.00)	**11 (22.00)**
38	14 (28.00)	**12 (24.00)**
39	15 (30.00)	**23 (46.00)**
40	–	**4 (8.00)**
Total	**50**	**50**
Mean GA ± Standard deviation (weeks)	**38.33 ± 0.96**	**38.81 ± 0.92**
Statistical inference	**t=2.55; p=0.01; Highly significant**	

Table 5: Distribution of patients according to NST in cases and controls

NST	Cases (n=50) No. (%)	Controls (n=50) No. (%)	Statistical inference (Fisher's exact test)
Reactive	29 (58.00)	41 (82.00)	**p=0.01; Highly significant**
Non-reactive	21 (42.00)	9 (18.00)	
Total	**50**	**50**	

Table 6: Distribution of patients according to mode of onset of labour cases and controls

Mode of onset of labour	Cases (n=50) No. (%)	Controls (n=50) No. (%)	Statistical inference (Fisher's exact test)
Induced	38 (76.00)	11 (22.00)	**p<0.0001; Highly significant**
Spontaneous	12 (24.00)	39 (78.00)	
Total	**50**	**50**	

Table 7: Distribution of patients according to mode of delivery in cases and controls

Mode of delivery	Cases (n=50) No. (%)	Controls (n=50) No. (%)	Statistical inference (Fisher's exact test)
Vaginal	22 (44.00)	36 (72.00)	
Caesarean Section	28 (56%)	14 (28%)	**p=0.008; Highly significant**
❖ **Fetal Distress**	19 (38%)	3 (6%)	
❖ **Other Indications**	**9 (18%)**	**11 (22%)**	

Table 8: Distribution of patients according to color of liquor in cases and controls

Colour of liquor	Cases (n=50) No. (%)	Controls (n=50) No. (%)	Statistical inference (Fisher's exact test)
Clear	22 (44.00)	40 (80.00)	**p=0.0004; Highly significant**
Meconium	28 (56.00)	10 (20.00)	
Total	**50**	**50**	

Table 9: Distribution of patients according to the neonatal birth weight in cases and controls

Neonatal birth weight (kg)	Cases (n=50) No. (%)	Controls (n=50) No. (%)	Statistical inference (Fisher's exact test)
<2.5	28 (56.00)	2 (4.00)	**p<0.0001; Highly significant**
≥2.5	22 (44.00)	48 (96.00)	
Total	**50**	**50**	
Mean birth weight ± Standard deviation (kg)	**2.33 ± 0.48**	**2.90 ± 0.38**	
Statistical inference (unpaired t test)	**t=6.58; p<0.0001; Highly significant**		

Table 10: Distribution of patients according to Apgar Scores at 1 minute and at 5 minutes in cases and controls

Apgar Scores	Cases (n=50) No. (%)	Controls (n=50) No. (%)	Statistical inference (Fisher's exact test)
At 1 minute			
≤7	16 (32.00)	2 (4.00)	**p=0.0004; Highly significant**
>7	34 (68.00)	48 (96.00)	
At 5 minutes			
≤7	4 (8.00)	1 (2.00)	**p=0.36; Not Significant**
>7	46 (92.00)	49 (98.00)	
Mean Apgar Score ± Standard deviation	**9.56 ± 1.68**	**9.92 ± 0.56**	
Statistical inference (unpaired t test)	**t=1.43; p=0.15; Not significant**		

Table 11: Comparison of perinatal morbidity in cases and controls

Perinatal morbidity		Cases (n=50) No. (%)	Controls (n=50) No. (%)	Statistical inference (Fisher's exact test)
NICU admission	Yes	10 (20.00)	1 (2.00)	**p=0.007; HS****
	No	40 (80.00)	49 (98.00)	
Respiratory distress	Yes	3 (6.00)	1 (2.00)	**p=0.61; NS***
	No	47 (94.00)	49 (98.00)	
Meconium aspiration	Yes	2 (4.00)	0	**p=0.49; NS***
	No	**48 (96.00)**	**50 (100.00)**	

*NS – Not significant; **HS – Highly significant

Table12: Comparison of perinatal mortality in cases and controls

Perinatal Mortality		Cases (n=50) No. (%)	Controls (n=50) No. (%)	Statistical inference (Fisher's exact test)
Still birth	Yes	1 (2.00)	0	**p=1.00; NS**
	No	49 (98.00)	50 (100.00)	
Neonatal death	Yes	2 (4.00)	0	**p=0.49; NS**
	No	**48 (96.00)**	**50 (100.00)**	

NS – Not significant

Table 13: Follow-up results after 7 days in cases and controls

Follow-up after 7 days	Cases (n=50) No. (%)	Controls (n=50) No. (%)
Healthy baby	38 (76.00)	**49 (98.00)**
IUGR	3 (6.00)	–
Jaundice	2 (4.00)	-
Low birth weight	4 (8.00)	-
Respiratory distress syndrome	1 (2.00)	**1 (2.00)**
Still birth	1 (2.00)	–
Neonatal death	**2 (4.00)**	–

IV. Discussion

Several attempts have been made to evaluate amniotic fluid volume sonographically to improve perinatal diagnosis criteria and make better predictions concerning the pregnancy. The present study was done on 100 patients. Study group consisted of 50 patients with AFI <5 cm and control group consisted of 50 patients with AFI ≥ 5cm.

The mean amniotic fluid index in the present study was 3.45 ± 1.7 cm of the study group. Sadovsky and Christensen, Conway *et al.* and Voxman *et al.* reported mean amniotic fluid index in their respective studies to be 2.9 cm, 3.1 cm and 3.2 cm (17,18,19), all of which are comparable to our study. The mean maternal age of the study group was 25.16

±3.61years in the present study, which is comparable to those reported by Casey *et al.*

(23.9 years) and Voxman *et al.* (27.3 years) (2,19).

Our study had more number of primigravida in study group (72%), while Larson *et al.* and Garmel *et al.* observed and 49% and 61.1% respectively to be nulliparous in their respective studies (20,21). The mean gestational age at delivery in the present study was

38.33 ± 0.96 weeks in study group, which is in accordance with series by Casey *et al.* and Garmel *et al.*

(2,21). The mean gestational age at delivery was found to be 37.3 and 38 weeks respectively in their studies. NST was non-reactive among 42% of the patients in our study group, which is similar to that reported by Sriya and Singhai (41.55%) (22).

Oligohydramnios causes increase in the incidence of induction of labour. In the present study 76% patients were induced and 24% patients went into spontaneous labour in study group, which is comparable to the one reported by Sultana *et al.* (63.4%) (23). There is a high incidence of caesarean section as a mode of delivery in patients with oligohydramnios. In our study, 56% of the patients of study group underwent LSCS, whereas in control group the rate of LSCS was 28%. Chauhan *et al.* in their study concluded that antipartum and intrapartum amniotic fluid index <5 cm is associated with increased risk of caesarean section for fetal distress and low Apgar score at birth (15). Of 56% of the patients who delivered by caesarean section, 38% underwent caesarean section due to fetal distress. A higher incidence of caesarean section (77.8%), of which 22.2% were for fetal distress, was reported in a series by Jeng *et al.*(24).

In a study by Sarno *et al.*, there was increased incidence of meconium staining and variable deceleration when amniotic fluid index was less than 5 cm (25). Druzin and Adams (1990), found a positive correlation between meconium staining and absence of fluid at amniotomy (26). In the present study, meconium stained liquor was seen in 56% of patients in study group. Jeng *et al.* and Youssef *et al.*, in their respective studies observed meconium staining in 66.7% and 40% patients respectively (24,27). On the other hand in the study by Garmel *et al.* and Golan *et al.*, the incidence of meconium stainingwas17.3% and 29.1%respectively(21,28).These observations suggest that in the study conducted in the developing nations, there is increased incidence of meconium staining and poor placental reserve.

In our study, 56% of neonate had birth weight <2.5 kgs in study group. The occurrence of low birth weight neonates was comparable with other studies like Sriya and Singhai (58.38%) and Chandra *et al.* (61.53%) (22,29).

Low Apgar score in oligohydramnios can be due to head and cord compression. In study group, Apgar score at 1 minute was <7 in 32% of neonates, while at 5 minutes it was <7 in 8% of neonates which is comparable with the results of Jeng *et al. i.e.* 33.3% and 11.1% respectively (24).

There is increased incidence of NICU admissions in neonates born to mothers with oligohydramnios. In our study 20% of the neonates were admitted in NICU because of low birth weight, respiratory distress syndrome, meconium aspiration, IUGR and jaundice. The incidence of NICU admissions in study conducted by Garmel *et al.* is in agreement with our study (21).

Oligohydramnios has been recognised as a clinical hallmark of impending severe perinatal compromise. The present study showed 6% perinatal deaths, out of which 2% were still births and 4% neonatal deaths. The incidence of perinatal death in a study by Youssef *et al*. was found to be 10% whereas higher incidence of perinatal death (16%) was observed by Golan *et al*. (27, 28). On the other hand Casey *et al.* reported 6.4% perinatal deaths, out of which 1.4% were still birth and 5% were neonatal deaths(2).

V. Conclusion

Oligohydramnios (AFI<5cm) is associated with increased pregnancy interventions in the form of induction of labour and caesarean delivery, intrauterine deaths and non-reactive fetal heart. There is also an increased neonatal morbidity (respiratory distress syndrome, meconium aspiration, low birth weight, IUGR, low Apgar score at birth) and perinatal mortality. Determination of AFI can be used as an adjunct to the other fetal surveillance methods. It helps to identify infants at risk of poor perinatal outcome. Moreover, AFI is a valuable screening test for predicting fetal distress in labour requiring caesarean section.

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