Original Article

Adverse Perinatal Outcome in Polyhydramnios : Is Gestational Age Specific Centiles Better Predictor to Amniotic Fluid Index ?

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Abstract

Background : To compare and assess the maternal and fetal outcomes in women detected with Polyhydramnios by gestational age-specific centile method (amniotic fluid volume >95th centile) with those by Amniotic Fluid Index >24 cm across all gestational age-based methods.

Materials and Methods : This was a prospective comparative and observational study conducted between February, 2019 and July, 2020 at Fernandez Hospital, Hyderabad. A total of 936 singleton pregnancies with gestational age >28 weeks with Polyhydramnios were included and these women were segregated into two groups with 468 each. Both groups were followed up for their perinatal outcomes. The primary outcome was the prediction of a composite adverse perinatal outcome consisting of one or more Major fetal structural malformations, stillbirths, 5 min Apgar score 24 hours and Jaundice requiring phototherapy or early neonatal death.

Results : The study revealed a statistically significant increased incidence of preterm births, cesarean rates, low birth weight babies and composite adverse perinatal outcome in AFI>24cm when compared with gestational age-specific centiles (AFV>95th Centile).

Conclusion : The use of the gestational age-specific centile method has increased the prevalence of Polyhydramnios by increasing the rate of diagnosis of Polyhydramnios without improving perinatal outcomes. Taking into consideration the limitation of gestational age-specific nomograms, their availability, cost-effectiveness and our results showed in this study, the Amniotic fluid index method (AFI>24cm) is a better choice for labeling Polyhydramnios.

Key words : Polyhydramnios, Amniotic Fluid Index, Gestational Age Specific Centile, Composite Adverse Perinatal Outcome (CAPO).

Amniotic fluid protects fetus from traumatic forces, provides thermal stability and helps in normal growth of the fetal lungs, musculoskeletal and gastrointestinal systems by providing necessary space and growth factors[1] and it has antibacterial properties that gives protection against infection and it indicates fetal wellbeing.

Increased use of ultrasound has led to increased detection of polyhydramnios and clinically Polyhydramnios is suspected when fundal height exceeds period of gestation. The Amniotic fluid volume above the 95th centile for that gestational age is defined as Polyhydramnios [2]. Although gestational-age-specific thresholds can be applied to define Polyhydramnios, but also a constant value of AFI ≥24 cm or DVP ≥8 cm can be used across all gestational ages[3-5]. Based on AFI/DVP, the condition can be classified as Mild (AFI of 25cm-30cm or DVP of 8-12cm), Moderate (AFI of 30.1-35cm or DVP of 12cm-16cm) or Severe (AFI of >35.1cm or DVP of >16 cm)[6]. Polyhydramnios complicates 1-2% of all pregnancies, fetal and maternal causes account for 30-40% of

Editor's Comment :

- Polyhydramnios has many controversies in its diagnosis and management.
- Use of the gestational age-specific centiles method has increased the prevalence of Polyhydramnios by increasing the rate of diagnosis of Polyhydramnios without improving perinatal outcome.
- Taking into consideration about the limitation of usage of gestational age specific nomograms based on its availability, and need for specific software for its usage, cost effectiveness and the results showed in this study, traditional method of detection of Polyhydramnios by amniotic fluid index method (AFI ≥24 cm across all gestational ages) is a better choice than gestational age specific centiles method (amniotic fluid volume ≥95th centile) for labeling Polyhydramnios.

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Received on : 27/06/2023
Accepted on : 20/08/2024

How to cite this article : Adverse Perinatal Outcome in Polyhydramnios : Is Gestational Age Specific Centiles Better Predictor to Amniotic Fluid Index ? Kadiyala VL, Singh A, Vavilala S. *J Indian Med Assoc* 2025; **123(7):** 18-22.

cases, whereas 50-60% are idiopathic[3]. Polyhydramnios occurring early in gestation results in high perinatal morbidity and mortality and that occurs late in gestation is usually mild and is not associated with structural anomalies. Pregnancy complications associated with Polyhydramnios include preterm births, Abruption, prelabour rupture of membranes, abnormal fetal presentation, prolonged second stage, Cord prolapse, higher rates of Caesarean section, Postpartum hemorrhage. Fetal Outcomes include increased incidence of structural anomalies, intrauterine demise, Macrosomia, Low birth weight, Low 5-minute Apgar scores, transient tachypnoea of new born, birth asphyxia and neonatal death. Early detection of polyhydramnios and its appropriate antenatal management can help the clinician to prevent the foreseen complications related to adverse perinatal outcome. In modern obstetrics, USG plays a crucial role for diagnosis and management of Polyhydramnios.

Aims and Objectives

To provide the best evidence-based management of Polyhydramnios, by comparing and assessing maternal and fetal outcomes in women detected with Polyhydramnios by two USG based methods that are gestational age specific centiles and AFI ≥24 cm across all gestation-based method.

Materials and Methods

This was a prospective, Comparative and Observational Study conducted between February, 2019 and July, 2020 in Department of Obstetrics and Fetal Medicine at Fernandez hospital, Hyderabad, a tertiary referral Centre in south India. Sample size was calculated by using PS (version 3) sample size calculation software. From the previous literature, it is observed that the incidence of still births in Polyhydramnios with AFI ≥24 cm is 6%[10]. So, assuming incidence of adverse outcomes as 6% and default level of significance (alpha) as 0.05, sample size of 468 for each group were included. All Women who booked and delivered at Fernandez Hospital with Singleton Pregnancies having an ultrasound done between 28 to 40 weeks and diagnosed as Polyhydramnios are assessed for eligibility. Multiple pregnancies, women delivered outside Fernandez hospital are excluded from the study.

All eligible women were enrolled into the study after taking a written consent. Ultrasound scan was used to determine AFI and authenticate as Polyhydramnios. Ultrasound was done on Voluson /Philips's machine using a trans abdominal probe with a frequency of 3-5Mhz by an experienced fetal medicine specialist using a standard technique. AFI ≥24 cm across all gestational ages is taken as Polyhydramnios in AFI based method, and in centile based method AFV >95th centile for that gestational age is taken as criteria to define polyhydramnios.

A systematic search for an underlying cause of Polyhydramnios in each case by thorough Fetomaternal examination and investigations like diabetes screening, maternal blood group Rh status, detailed USG examination of the fetus from top to toe to exclude any structural abnormality was done. Repeated ultrasound for AFI evaluation was done every 4 to 6 weeks and before delivery. These patients were followed up during pregnancy, labor and neonates are followed at birth till 7 days. The frequency of adverse outcomes based on each USG based method were obtained and the maternal and neonatal outcomes were analyzed and compared between two groups. Adverse Perinatal outcomes are assessed in terms of complications like preterm births, Abruption, prelabour rupture of membranes , abnormal fetal presentation, prolonged second stage, cord prolapse, higher rates of Caesarean sections, postpartum hemorrhage, fetal outcomes include increased incidence of macrosomia, low birth weight baby, Composite Adverse Perinatal Outcome (CAPO) consisted of one or more of : Major fetal structural malformations, still birth, 5 min Apgar score <7, NICU admissions >24 hours, Jaundice requiring photo-therapy or early neonatal death (up-to 7 days).

All Quantitative variables were checked for normal distribution within each category of explanatory variable. Shapiro- wilk test was also conducted to assess normal distribution. Shapiro wilk test 'p' value of >0.05 was considered as normal distribution. For normally distributed Quantitative parameters the mean values were compared between study groups using independent sample t-test (2 groups). For normally distributed Quantitative parameters the mean values were compared between study groups using Mann Whitney 'U' test. P value <0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis[4,6].

Results

In our study, 10.6% (50) women had age ≥35 years, 29.8% (140) women had BMI >30 in those with polyhydramnios detected by gestational age specific centiles (AFV≥95th centile) and 14.7% (69) and 30.13% (141) respectively in those with AFI≥ 24cm, both groups had comparable age group and body mass index. Rh factor had no impact on incidence of Polyhydramnios detected by either of the methods. 53.2% of women were detected with Polyhydramnios < 32 weeks by AFI ≥24cm method were as only 30.1% by gestational age specific centiles (AFV≥95th centile), gestational age at diagnosis is statistically significant between two groups (P value <0.001). Many cases diagnosed with Polyhydramnios by gestational age specific centiles (AFV≥95th centile) had spontaneous resolution when compared AFI≥24cm group. Malpresentation, preterm deliveries, Cesarean section rates were high in AFI ≥ 24cm, neonatal complications like Trauma at birth, neonates requiring resuscitation, jaundice, respiratory distress, low Apgar, low birth weight babies, macrosomia were more in AFI≥24 cm (Table 1). Incidence of IUFDs, neonatal deaths, major malformations, NICU admissions> 24 hrs is high in group with AFI ≥24 cm when compared with gestational specific centiles (AFV≥95th Centile) and is statistically significant (Table 2). The factors associated with composite outcome were discussed (Table 3).

Note: AFV≥95th Centile group, absence of anemia, ≥32 weeks, absence of resolution of Polyhydramnios, term delivery (≥37 weeks) and normal delivery were taken as reference category for method of detection, anemia, gestational age at diagnosis, resolution of Polyhydramnios, gestational age at delivery and mode of delivery respectively. In the univariate analysis, method of detection of Polyhydramnios, anemia, gestational age at diagnosis and gestational age at delivery were found to be statistically significantly associated with composite outcome. After adjusting con-founders and applying multivariate analysis it was found that method of detection of Polyhydramnios and gestational age at delivery were found to be statistically significantly associated with Composite Adverse Perinatal Outcome (CAPO). So, it was concluded that in the multivariable analysis, AFI ≥24cm group were 3.86 times (aOR: 3.86, 95% CI: 2.43, 6.12) more likely associated with Composite Adverse Perinatal Outcome (CAPO) as compared to AFI≥95th Centile group.

Table 1 — *Comparison of Demographic Characteristics, Maternal and Neonatal Outcomes Between Study Groups*

Parameters	Study Groups		P value
	Gest. age specific centiles group (AFV≥95th Centile) (N=468)	AFI ≥24cm group (N=468)	
Age >35 years	50 (10.68%)	69 (14.74%)	0.172
Booking BMI ≥ 30	140 (29.8%)	141 (30.13%)	1.000
Rh -ve factor	20 (4.27%)	30 (6.41%)	0.280
Hypertensive disorders	84 (17.95%)	84 (17.95%)	1.000
Pre-gestational diabetes	28 (5.98%)	42 (8.97%)	0.197
Gestational diabetes	161 (34.4%)	174 (37.18%)	0.529
Anemia	131 (27.99%)	81 (17.31%)	0.008
Hypothyroid	170 (36.32%)	168 (35.9%)	0.923
Gestational age at diagnosis <32 weeks	141 (30.13%)	252 (53.85%)	<0.001
Resolution of polyhydramnios	187 (39.96%)	132 (28.21%)	0.008
Malpresentation	24 (5.13%)	42 (8.97%)	0.082
Preterm delivery(<37 weeks)	35 (7.48%)	90 (19.23%)	<0.001
Induction of labour	152 (32.48%)	153 (32.69%)	0.961
Caesarean delivery	233 (49.79%)	318 (67.95%)	<0.001
Abruption	2 (0.43%)	0 (0.00%)	1.000
Cord prolapse	2 (0.43%)	3 (0.65%)	1.000
Postpartum Hemorrhage	33 (7.05%)	27 (5.77%)	0.712
Neonatal Trauma at birth	3 (0.64%)	6 (1.28%)	0.603
Low birth weight	34 (7.26%)	48 (10.26%)	0.223
Major malformations	28 (5.98%)	57 (12.18%)	0.011
Macrosomia	86 (18.38%)	123 (26.28%)	0.033
Resuscitation at birth	6 (1.28%)	24 (5.13%)	0.010
Respiratory distress (RDS)	33 (7.05%)	87 (18.59%)	< 0.001
Neonatal hypoglycemia	8 (1.71%)	6 (1.28%)	1.000
Jaundice requiring photo therapy	70 (14.96%)	108 (23.08%)	0.019

Table 2 — *Comparison of Primary Outcomes Between study Groups*

Outcomes	Study Groups		P value
	Gest. age specific centiles group (AFV≥95th Centile) (N=468)	AFI ≥24cm group (N=468)	
Major fetal structural malformations	28 (5.98%)	57 (12.18%)	0.011
Still birth	1 (0.41%)	9 (1.92%)	0.082
1-min Apgar score <7	19 (4.06%)	57 (12.18%)	< 0.001
NICU admissions >24 hours	33 (7.05%)	147 (31.41%)	<0.001
Early Neonatal deaths (up to 7 days)	1 (0.41%)	9 (1.92%)	0.082
Composite Adverse Perinatal Outcome (CAPO)	62 (13.25%)	186 (39.74%)	<0.001

Discussion

Polyhydramnios has many controversies in its diagnosis and management. In our study a total of 936 pregnant women were observed during antenatal period, at the time of delivery and neonates after birth. Incidence of polyhydramnios in our study is 18%, which is very high when compared with previous

Table 3 — *Binary Logistic Regression to Assess the Factors Associated with Composite Outcome*

Variables	Uni-variate analysis		Multivariate analysis	
	cOR (95% CI)	P-value	aOR (95% CI)	P-value
Method : AFI≥25cm group	4.32(2.85-6.56)	<0.001	3.86(2.43-6.12)	<0.001
Anemia : Present	0.58(0.35-0.95)	0.032	0.69(0.40-1.18)	0.173
Gestational age at diagnosis : <32 weeks	1.75(1.18-2.61)	0.006	0.99(0.61-1.60)	0.968
Resolution of polyhydramnios : Present	1.05(0.70-1.57)	0.820	1.24(0.78-1.99)	0.361
Gestational age at delivery : Preterm delivery (<37 weeks)	5.72(3.34-9.77)	<0.001	4.73(2.63-8.50)	<0.001
Mode of delivery : Caesarean delivery	1.31(0.88-1.96)	0.182	0.93(0.60-1.45)	0.756

literature[4,8,9]. High incidence is probably because our study is conducted in a tertiary referral Centre and also because of higher detection rates of Polyhydramnios by gestational age specific centiles method.

Gestational diabetes and Pregestational diabetes were seen in 34% and 5.9 % in Group A, 37% and 8.9% in Group B respectively. In our study, incidence of Polyhydramnios is slightly higher in GDM group when compared with Pre GDM probably because of better glycemic control and preparedness in the later group and although this finding was not statistical significant, but overall association of diabetes with Polyhydramnios is much more higher in this study as compared with other studies published by Prerna, *et al* (7%)[11], Rajgire AA, *et al* (8%)[8] and were as less compared with Maliha, *et al* (44%)[15]. Mostprobable reason for higher association might be because study was conducted in a referral Centre where meticulous screening for diabetes is done based on risk factors.

More than half (53%) of women were diagnosed with polyhydramnios before 32 weeks in Group B and 30% in Group A.These results showed higher numbers when compared with other study by Prerna, *et al* (21%)[12], reasons for early detection of Polyhydramnios include the study being conducted in a referral Centre with meticulous GDM screening protocol, precise antenatal surveillance with early third trimester scans. There was statistically significant difference between these two groups in terms of resolution of polyhydramnios in later part of pregnancy, 39% in group A had resolution compared with 28% in Group B and the cause is idiopathic. This indicated over diagnosis of cases by centile based method in Group A.

5% had Malpresentation at the time of delivery, 7% had preterm deliveries, 49% had caesarean deliveries in Group A, compared with 8.9% Malpresentations, 19% preterm deliveries, 68% Caesarean deliveries in Group B and incidence of preterm deliveries in Group B is comparable with previous studies done by Tarek, *et al* (16%)[12] but less than the study conducted by Prerna, *et al* (45%)[11]. Main indications for caesarean deliveries include Presumed fetal compromise, previous LSCS and maternal request and incidence of caesarean deliveries in our study is high when compared with Aviram, *et al* (12%)[14], Nazima, *et al* (36%)[12], Prerna, *et al* (31%)[11]. Rate of IOL (32% and 32 %), Cord prolapse (0.43% and 0.65%) Abruption (0.43% and 0%), PPH (7% and 5.7%) in Group A and Group B respectively and there is no statistical significance between two groups. In our study, Induction rates are high compared to Aviram, *et al*[14] and among the indications for Induction of labour PGDM/GDM is the commonest indication in both groups.

1.2% required resuscitation immediately after birth,14.9% had jaundice requiring photo therapy, 7% neonates had respiratory distress in group with polyhydramnios by gestational age specific centiles when compared with 5%, 23% and 18% respectively in group with AFI ≥ 24cm, and there is statistical significance. More no. of babies required resuscitation and had jaundice requiring phototherapy, reasons include extremities of birth weight, high incidence of caesarean sections in Group with AFI ≥24cm. 4% had low Apgar's at 1 min in group with polyhydramnios by gestational age specific centiles (AFV≥95C) and 12% in group with AFI≥24cm. Overall results of low Apgar scores were comparable with previous literature by Tarek, *et al*[14] and lower than Asadi N, *et al*[9]. 7.9% had Birth weight <2.5kg and 2.5% had weight >4kg in group with polyhydramnios by gestational age specific centiles (AFV>95C) and 16% had weight <2.5 kg and 3% had >4kg in group with AFI ≥24cm, but the incidence of low birth weight babies is less compared to Asadi N, *et al* (35%)[9] and macrosomia is less when compared to study by Asadi N, *et al* (6%)[9], Prerna, *et al* (7%)[11].

0.4% had still births, 0.4% had neonatal deaths, 5.9% had major malformations detected after birth, 7% had NICU admissions for >24 hours in group with

Polyhydramnios by gestational age specific centiles (AFV≥95C) and 1.9% had still births,1.9% had Neonatal deaths,12% had major malformations and 31% had NICU admissions >24 hrs in group with AFI ≥24cm and overall incidence of adverse perinatal outcomes was 11% in earlier group and 37% in the later and is statistically significant. Though incidence of major fetal structural malformations is not statistically significant in both groups but high incidence of gastrointestinal abnormalities like Congenital Diaphragmatic Hernia, Tracheoesophageal Fistula, Duodenal Atresia, Esophageal Atresia in AFI ≥24 cm group is noted. Previous literature showed results as Manjula, *et al* (perinatal deaths 33.9%)[10], Nazima, *et al* (perinatal mortality 2%)[12], Prerna, *et al* (still birth 2%, Neonatal deaths 17%)[11], Rajgire AA, *et al* (perinatal deaths 5%)[8], Asadi N, *et al* (still birth 6%, neonatal deaths 21%, NICU admissions 38%)[9].

Conclusion

In conclusion, there is no previous literature available for comparing old traditional method of diagnosis of polyhydramnios by amniotic fluid index ≥24 cm method (across all gestational ages) with those by newer gestational age specific centiles method (amniotic fluid volume ≥95th centile for that specific gestation). Use of the gestational age specific centiles method has increased prevalence of Polyhydramnios by increasing the rate of diagnosis of Polyhydramnios without improving perinatal outcome. Taking into consideration about the limitation of usage of gestational age specific nomograms based on its availability, and need for specific software for its usage, cost effectiveness and the results showed in this study, traditional method of detection of Polyhydramnios by amniotic fluid index method (AFI ≥24 cm across all gestational ages) is a better choice than gestational age specific centiles method (amniotic fluid volume ≥95th centile) for labeling Polyhydramnios. But indeed, gestational age specific centile method has its own advantages in terms of alerting the clinician to look in detail into fetus and it reflects variation in AFI as per gestational ages. So, further large-scale population-based studies are needed for comparing both methods for labeling Polyhydramnios in pregnancy in different geographical areas.

Funding : None

Conflict of Interest : None

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