International Journal of Contraception, Gynaecology and Obstetrics

ISSN Print: 2664-9861
ISSN Online: 2664-987X
Impact Factor: RJIF 5.42
IJGS 2022; 4(1): 09-14
www.gynaecologyjournal.net
Received: 04-01-2022
Accepted: 09-02-2022

Dr. Amit A Rajwade
MBBS, DNB
OBGY, Consultant Obstetrician and Gynaecology
Dr. Joglekar Hospital, Shirwal
Maharashtra, India

Dr. Zarna Patel
MBBS, DNB OBGY,
Consultant Obstetrics and gynaecology Sharda Hospital, Surat Gujarat, India

Dr. Anita Soni
MBBS, MS, FCPS, FICOG,
Consultant Obstetrician and Gynaecology, Dr. L H Hiranandani Hospital, Powai, Mumbai, Maharashtra, India

Corresponding Author:
Dr. Amit A Rajwade
MBBS, DNB
OBGY, Consultant Obstetrician and Gynaecology
Dr. Joglekar Hospital, Shirwal
Maharashtra, India

Maternal risk factors and perinatal outcomes inantenatally diagnosed oligohydramnios

Dr. Amit A Rajwade, Dr. Zarna Patel and Dr. Anita Soni

Abstract
Objective: Our study aims to study the maternal risk factors and perinatal outcomes in antenatally diagnosed oligohydramnios"
Study design: Hospital based prospective observational study
Methods and materials: The present study was a prospective observational study conducted at Dr L. H. Hiranandani Hospital from 01/09/16 to 30/03/18.This study was carried out after obtaining clearance from the institutional ethical committee.
Antenatal women with singleton pregnancy registered / referred to our hospital at or beyond 28 weeks of gestation with clinically suspected oligohydramnios were screened. Thorough history taking, complete examination and baseline investigations were done for all the cases. Ultrasound examination was done for these women and AFI was calculated by four quadrant amniotic fluid volume measurement technique as described by Phelan, *et al.*[1] A curvilinear transducer was used. By marking, the uterus was divided into four quadrants using the maternal sagittal midline vertically and an arbitrary transverse line approximately half way between the symphysis pubis and upper edge of uterine fundus. The transducer was kept parallel to the maternal sagittal plane and perpendicular to the maternal coronal plane throughout. The deepest, unobstructed and clear pocket of amniotic fluid was visualized and the image was frozen. The ultrasound calipers were manipulated in such a way that it measured the pocket in a strictly vertical direction. The process was repeated in each of the four quadrants. AFI was then calculated. Thus, antenatal women with singleton pregnancy at or beyond 28 weeks of gestation with decreased AFI (AFI < / = 8 cm) on ultrasonography were included in the study. Written informed consent was taken after explaining the purpose of the study. The study did not compromise with any treatment/care given routinely to them.
Results: It was observed that a higher incidence of antenatal high risk factors and adverse perinatal outcome was seen in higher percentage of patients having severe oligohydramnios than that of borderline oligohydramnios. We observed that decreased AFI (AFI < / = 5 cm) was associated with increased incidence of induction of labour, atypical / abnormal NST, meconium staining of liquor, incidence of LSCS, low APGAR score at 5 minutes and NICU admissions. Amniotic fluid volume measured in terms of AFI is a good predictor of adverse perinatal outcome.
Conclusion: Oligohydramnios is as an indicator of the possible presence of maternal factors e.g. gestational hypertension, fetal growth restriction (FGR), abruptio placentae. It is an indicator of poor perinatal outcome. Estimation of amniotic fluid volume should be a part of antenatal fetal surveillance. Amniotic fluid volume measured in terms of amniotic fluid index (AFI) is a helpful tool in determining patients at risk. Severe oligohydramnios, as compared to borderline oligohydramnios is significantly associated with pregnancy complications and perinatal morbidity and mortality such as increased incidence of induction of labour, atypical / abnormal non stress test (NST), Meconium staining of liquor, increased incidence of LSCS, Low APGAR score at 5 minutes, Increased NICU admissions. This highly significant statistical correlation between oligohydramnios and poor perinatal outcome suggests that AFI in adjunct with other methods of fetal surveillance can be used to identify patients at risk. Detailed history taking, experienced clinical judgment, strict antepartum and intrapartum surveillance can reduce perinatal complications.

Keywords: Amniotic fluid index, oligohydramnios, perinatal, antenatal, meconium, fetal distress

Introduction
Water is the elixir of life; but the aquatic environment that surrounds the fetus has long remained a mystery. Early in the developmental life, fetus becomes enclosed by the amnion and is surrounded by the amniotic fluid which is a highly specialized form of extra-cellular fluid which supports the normal growth, development and wellbeing of the fetus [2]. The resultant volume of amniotic fluid is due to an intricate balance between its absorption and production. Volume of amniotic fluid decreases with increasing gestational age beyond 38

weeks. Usual amount of amniotic fluid is approximately 1000ml at term [3].

The importance of amniotic fluid volume as an indicator of fetal wellbeing has made its assessment an important part of antenatal fetal surveillance. The various methods for the estimation of amniotic fluid volume are the dye dilution technique, amniotic fluid index (AFI) and measurement of single deepest pocket (SDP) [1, 4]. The advent of ultrasound methods for imaging of the fetus and its environment has improvised the obstetric care due to its reliability, ease of measurement and lack of any risks to the mother and the fetus. Most of the times, fetii at high risk can be identified by estimation of amniotic fluid volume using the AFI, which is the semi quantitative measurement of amount of amniotic fluid. It is calculated by adding the depth in centimeter of the largest vertical pocket in each of the four quadrants. It is an important parameter of the biophysical profile which is a standard tool in ante partum fetal assessment after 28 weeks of gestation [5]. Reduced volume of amniotic fluid or oligohydramnios poses a challenge to the obstetrician. It can develop any time during the pregnancy, but is more common in the third trimester, the incidence being 3-8%.[6] Oligohydramnios is defined as amniotic fluid volume <5% for gestational age, AFI <5 cm or SDP < 2 cm.[7] Oligohydramnios can be caused due to fetal anomalies like renal agenesis, polycystic kidney disease, posterior urethral valves; maternal risk factors like malnutrition, gestational hypertension, diabetes with vasculopathy, smoking, drug intake or placental insufficiency. It is associated with an increased incidence of fetal growth restriction (FGR), fetal distress, meconium aspiration syndrome [4]. (MAS), instrumental delivery / caesarean delivery severe birth asphyxia, low APGAR score and high perinatal morbidity and mortality [3, 7]. Early detection of oligohydramnios helps in reduction of maternal &fetal morbidity and mortality. However, some studies have failed to show an association between adverse perinatal outcomes and oligohydramnios [8, 9, 10].

Therefore, the present study is carried out to determine the maternal risk factors associated with oligohydramnios and its effects on maternal and perinatal outcomes.

Materials and Methods

The present study was a prospective observational study conducted at Dr L. H. Hiranandani Hospital from 01/09/16 to 30/03/18.This study was carried out after obtaining clearance from the institutional ethical committee

Antenatal women with singleton pregnancy registered / referred to our hospital at or beyond 28 weeks of gestation with clinically suspected oligohydramnios were screened. Thorough history taking, complete examination and baseline investigations were done for all the cases. Ultrasound examination was done for these women and AFI was calculated by four quadrant amniotic fluid volume measurement technique as described by Phelan, *et al*. [1] A curvilinear transducer was used. By marking, the uterus was divided into four quadrants using the maternal sagittal midline vertically and an arbitrary transverse line approximately half way between the symphysis pubis and upper edge of uterine fundus. The transducer was kept parallel to the maternal sagittal plane and perpendicular to the maternal coronal plane throughout. The deepest, unobstructed and clear pocket of amniotic fluid was visualized and the image was frozen. The ultrasound calipers were manipulated in such a way that it measured the pocket in a strictly vertical direction. The process was repeated in each of the four quadrants. AFI was then calculated. Thus, antenatal women with singleton pregnancy at or beyond 28 weeks of gestation with decreased AFI (AFI < / = 8 cm) on ultrasonography were included in the study. Written informed consent was taken after explaining the purpose of the study. The study did not compromise with any treatment/care given routinely to them.

Data were statistically described in terms of mean (± Standard deviation), frequencies (number of cases) and percentages when appropriate. Comparison of quantitative variables between the study groups was done using unpaired t-test for independent samples. For comparing categorical data, Chi square test was performed. Exact test was used instead when the expected frequency is less than 5. A probability value (p value) less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs Microsoft Excel 2007 (Microsoft Corporation, NY, USA) and SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 21.

The prevalence of oligohydramnios in Dr. LH Hiranandani Hospital, Powai is 7%. On the basis of 7% prevalence we calculated the sample size by using following formula n = 4*P*q/L2 and considering the power of study 80% and level of significance as 0.05 (5%). Where, P = prevalence of disease (7%) q = 1 – P (93%) L = Experimental Error Number of cases – 100

The sample size was divided into two study groups based on AFI i.e. AFI < / = 5 cm (severe oligohydramnios) and AFI 5.1 - 8 cm (borderline oligohydramnios).

Results

The demographic analysis of two groups revealed Table No.1 that mean age of the group with AFI < / = 5 cm was 29.80 years while that of the group with AFI 5.1 - 8 cm was 30.33 years. This difference was not statistically significant. (p value - 0.55) There was no statistically significant difference found between the groups with respect to their gravidity. (p value > 0.05) Table No.2

Table No. 3 shows that the difference between the incidence of fetal growth restriction across the two study groups was statistically significant (p value - 0.01) while that of the incidence of gestational hypertension, severe anemia, postdated pregnancy, abruptio placentae and intra uterine infection across the study groups was not statistically significant.

Table No. 4 states that there were total 29 (52.7%) cases of severe oligohydramnios who had meconium stained liquor of varying degrees where as in borderline oligohydramnios, meconium stained liquor was observed in 8 cases (17.7%). This showed that there was a statistically significant difference in the liquor status across the study groups. (p value < 0.01)

Table No. 5 shows that in the severe oligohydramnios group, 40 (72.7%) underwent LSCS, 8 (14.5%) had instrumental delivery and 7 (12.7%) had normal vaginal delivery. In the borderline oligohydramnios group, 8 (17.8%) underwent LSCS, 13 (28.9%) had instrumental delivery and 24 (53.3%) had normal vaginal delivery. This shows that severe oligohydramnios has higher rates of LSCS than borderline oligohydramnios. (p value < 0.01) It was observed that, normal vaginal delivery is more significantly

associated with borderline oligohydramnios. (p value < 0.01)

Table No. 6 shows that out of 19 patients who were taken up for LSCS in view of fetal distress, 17 patients had AFI < / = 5 cm while 2 patients had AFI of 5.1 - 8 cm. (30.9% v/s 4.4%). This difference was statistically significant. (p value < 0.01) Thus, fetal distress was more significantly associated with severe oligohydramnios. The above table also shows that, malpresentation (5.5% v/s 4.4%), non-progress of labour (7.3% v/s 2.2%) and severe FGR (7.3% v/s 0.0%) were also more significantly associated with severe oligohydramnios as compared to borderline oligohydramnios. (p value < 0.01)

Table No. 7 shows that of the 17 neonates with an Apgar score at 5 minutes of < / = 7, 14 (25.5%) had severe oligohydramnios whereas 3 (6.7%) had borderline oligohydramnios. This difference was statistically significant. (p value - 0.016) The above table also shows that the association of Apgar score at 5 minutes > 7 is more significantly associated with borderline oligohydramnios.

Table No. 8 shows that out of the 17 cases who required NICU admission, 14 (25.5%) had AFI < / = 5 cm whereas 3 (6.7%) had AFI 5.1 - 8 cm. This difference was statistically significant. (p value - 0.016)

Discussion

The mean maternal age of 100 women in our study was 30.04 years where as that of study by Kansal, *et al*. [11] was 23 years, Gaikwad, *et al*. [6] was 24.9 years and that by Rathod, *et al*. [12] was 23.7±6.7 years. As per my study, mean maternal age of the group with AFI </= 5 cm was 29.8 years while that of the group with AFI 5.1-8 cm was 30.3 years. This difference was not statistically significant (p value - 0.55). The association between mean maternal age and oligohydramnios is not statistically significant. Gaikwad, *et al*[6] also did not find statistically significant association between mean maternal age and oligohydramnios.(p value – 0.394) As per table 2, 64%patients were primigravidae whereas 36% were multigravidae. This observation was comparable with the study by Rathod, *et al*. [12] where 65.71% patients were primigravidae and 34.29% were multigravidae.

As per table 3, the most common risk factor associated with oligohydramnios in our study was FGR (38%). However, that in a study by Gaikwad, *et al*. [6] and Rathod, *et al*. [6] it was gestational hypertension. In our study, amongst all the antenatal risk factors, FGR was more significantly associated with the severe oligohydramnios group than the borderline oligohydramnios group. (p value- 0.01). Similarly Gaikwad, *et al*. [6] also showed a significant association between FGR and oligohydramnios. According to ACOG bulletin on FGR and ultrasonography in pregnancy [13], oligohydramnios is a common finding in growth restricted fetus and it is an important diagnostic and prognostic parameter. The bulletin stated that oligohydramnios occurs in 77-83% of pregnancies complicated with FGR. There was no statistically significant association found between other risk factors and oligohydramnios.

As per our study, patients had clear liquor and 37 patients had meconium staining of liquor in varying degrees. 24 patients had thin meconium while 13 patients had thick meconium. Gaur, *et al*. [14] observed higher incidence of meconium staining of liquor among cases with very low AFI (21%) and low AFI (22.2%) as compared with normal AFI (11.53%).Kansal, *et al*. [11] observed that liquor was clear in 76% of cases. In our study, it can be observed that of the 61 cases with clear liquor i.e. no meconium staining of liquor, 26 (47.3%) belonged to the severe oligohydramnios group whereas 35 (77.8%) belonged to the borderline oligohydramnios group. This difference was found to be statistically significant. (p value <0.01) Ghike, *et al*. [15] showed similar results. 54.05% cases with AFI < / = 5 cm and 26.98% cases with AFI 5.1 - 8 cm showed meconium staining of liquor and this difference was significant. In a study by Dasari, *et al*. [16], rate of meconium staining was 25% and they concluded that when the liquor volume decreases, the incidence of meconium staining increases and that it was statistically significant. The results of these studies are comparable. [14, 11, 16, 15] However, Gaikwad, *et al*. [6] did not find a statistically significant difference between meconium staining of liquor in the two groups (36.73% v/s 25.4%).

Table 6 show that, 38% patients went into spontaneous labour, 41% were induced and 21% were taken up for elective lower segment cesarean section (LSCS). More number of patients from the severe oligohydramnios group required induction of labour as compared to the borderline oligohydramnios group. (47.3% v/s 33.3%) This difference was statistically significant. (p value < 0.01) Gaikwad, *et al*. [6] showed that 38% patients went into spontaneous labour, 28% were induced and 34% were taken up for elective LSCS. However, they did not find significant association between severe oligohydramnios and requirement of induction of labour. In study by Kansal, *et al*. [11], 12.5% patients were directly taken up for elective LSCS in view of isolated severe oligohydramnios. But, in our study, 21% patients required elective LSCS. This higher incidence in our study could be because of inclusion of indications other than isolated severe oligohydramnios

Our study shows that 48 patients were delivered by LSCS whereas 52 patients were delivered vaginally. Of the 48 patients who underwent LSCS, 72.7% had severe oligohydramnios and 17.8% had borderline oligohydramnios. This difference was statistically significant. (p value < 0.01) This shows that the group with AFI < / = 5 cm has significantly higher rate of caesarean deliveries as compared to the group with AFI 5.1 - 8 cm. In a study by Ghike, *et al*. [15] the rate of LSCS in the severe and borderline oligohydramnios group was 35.14% and 14.28% respectively. Gaikwad, *et al*. [6] also observed that the rate of LSCS was 73.4% in the oligohydramnios with AFI < / = 5 cm group which was double as compared to the other group (37.2%) and it was statistically significant. (p value < 0.05). Also, in a study by Rathod, *et al*. [12] LSCS rate was significantly higher in the severe oligohydramnios group than the borderline oligohydramnios group. (p value < 0.001). Findings of studies by Dasari, *et al*. [16] comparing abnormal fetal heart rate (FHR) pattern and rate of LSCS deliveries showed similar results. Thus, it can be concluded that severe oligohydramnios is more significantly associated with a higher rate of LSCS.

In our study the most common indication for LSCS was fetal distress followed by previous LSCS. The incidence of malpresentation and non-progress of labour was equal. Kansal, *et al*. [11], Chetna Gopchade, *et al*. [17] and Jagatia, *et al*. [18] also reported fetal distress to be the most common indication for LSCS. However, Rathod, *et al*. [12] observed

that the most common indication for LSCS was oligohydramnios itself associated with some other condition (41.02%) followed by fetal distress and malpresentation (20.52%). Of the cases that were taken up for a LSCS for fetal distress, severe oligohydramnios was present in 30.9% as compared to borderline oligohydramnios in 4.4%. This difference was statistically significant. (p value < 0.01) Gaikwad, *et al.* [6] noted LSCS for fetal distress in 34. 6% cases of oligohydramnios and 11.7% cases of borderline oligohydramnios. A statistically significant difference was observed. (p value < 0.05) Ghike, *et al.* [15] noted that fetal distress as an indication of LSCS was significantly higher in the severe oligohydramnios group as compared to the borderline oligohydramnios group. (29.73% v/s 9.52%).Similar findings were seen in the study by Kabade, *et al.* [19].

Guin G, *et al.* [20] in their study noted that 80% of LSCS in oligohydramnios were done for fetal distress. Thus, severe oligohydramnios is more significantly associated with LSCS for fetal distress than borderline oligohydramnios. We also compared other indications for LSCS across the severe and borderline oligohydramnios groups. It shows that malpresentation, previous LSCS, non-progress of labour and severe FGR is more significantly associated with severe oligohydramnios group. (AFI < / = 5 cm) (p value < 0.01)

As seen in Table 7, higher incidence of low Apgar score < 7 at 1 and 5 minutes was observed in AFI < / = 5 cm. In our study, 31% had an Apgar score of < 7 at 1 minute which was comparable to 38.8%as observed by Sriya R, *et al*[21].17% had Apgar score of < 7 at 5 minutes as compared to 15% and 18.2% in studies by Jun Zhang, *et al.* [22] and Kansal, *et al.* [11] respectively. We did not observe a statistically significant difference across the study groups with regards to the Apgar score at 1 minute. This was comparable to the study by Gaikwad, *et al.* [6]. Ghike, *et al.* [7] observed that the percentage of neonates with Apgar score < 7 at 1 minute (32.43% v/s 17.46%) and 5 minutes (13.51% v/s 3.17%) was significantly higher in the severe oligohydramnios group as compared to the borderline oligohydramnios group. A systematic review and meta-analysis by Shrem G, *et al.* [23] noted a significant association between isolated oligohydramnios and low

Apgar scores at 1 and 5 minutes. Similarly, we found that the Apgar score < 7 at 5 minutes in our study was significantly associated with severe oligohydramnios group. Note-worthy is that, the Apgar score at 5 minutes is considered to be a better predictor of neonatal long-term outcome. 10 The rate of NICU admission as observed in our study was 17% and the most common indication for NICU admission was respiratory distress (7%). No significant difference was observed in the reasons for NICU admissions across the study groups. Kansal, *et al.* [11], Gaikwad, *et al.* [6] and Rathod, *et al.* [12] observed that the rate of admission to NICU was 15%, 24% and 25.72% respectively which was comparable to that of our study. Of the 17 NICU admissions in our study, 25.5% and 6.7% belonged to the severe and borderline oligohydramnios groups respectively. However, we did not find this difference to be statistically significant. Gaikwad, *et al.* [6] also did not find statistically significant difference in the rate of NICU admissions across the two groups. (28.5% in severe oligohydramnios group v/s 19.6% in borderline oligohydramnios group) (p value – 0.532) Ghike, *et al.* [7] found that, NICU admission rate to be 43.24% in severe oligohydramnios and 19.05% in borderline oligohydramnios and found it to be statistically significant.

In conclusion, oligohydramnios is as an indicator of the possible presence of maternal factors e.g. gestational hypertension, fetal growth restriction (FGR), abruptio placentae. It is an indicator of poor perinatal outcome. Estimation of amniotic fluid volume should be a part of antenatal fetal surveillance. Amniotic fluid volume measured in terms of amniotic fluid index (AFI) is a helpful tool in determining patients at risk. Severe oligohydramnios, as compared to borderline oligohydramnios is significantly associated with pregnancy complications and perinatal morbidity and mortality such as increased incidence of induction of labour, atypical / abnormal non stress test (NST), Meconium staining of liquor, Increased incidence of LSCS, Low APGAR score at 5 minutes, Increased NICU admissions. This highly significant statistical correlation between oligohydramnios and poor perinatal outcome suggests that AFI in adjunct with other methods of fetal surveillance can be used to identify patients at risk. Detailed history taking, experienced clinical judgment, strict antepartum and intrapartum surveillance can reduce perinatal complications.

Table 1: Comparison of age across the study groups

Variable	AFI (in cm)	Number	Mean	SD	p- value
Age (in years)	< / = 5	55	29.80	4.66	0.55
	5.1 - 8	45	30.33	4.12	

Table 2: Comparison of gravidity across the study groups

Gravidity	AFI (in cm)		Total
	< / = 5	5.1 - 8	
Primigravidae	34	30	64
	61.8%	66.7%	64.0%
Multigravidae	21	15	36
	38.2%	33.3%	36.0%
Total	55	45	100
	100.0%	100.0%	100.0%
p value - 0.85			

Table 3: Comparison of high risk factors across the study groups

High risk factors	AFI (in cm)		Total	p value
	< / = 5	5.1 - 8		
FGR	27	11	38	0.01
	49.1%	24.4%	38.0%	
Gestational hypertension	15	9	24	0.48
	27.3%	20.0%	24.0%	
Severe anemia	1	5	6	0.09
	1.8%	11.1%	6.0%	
Post-dated pregnancy	3	1	4	0.39
	5.5%	2.2%	4.0%	
Abruptio placentae	0	2	2	0.20
	0.0%	4.4%	2.0%	
Intrauterine infection	1	1	2	1.00
	1.8%	2.2%	2.0%	
Idiopathic	12	16	28	0.18
	21.8%	35.6%	28.0%	

Table 4: Comparison of liquor status across the study groups

Liquor status	AFI (in cm)		Total
	< / = 5	5.1 - 8	
Clear	26	35	61
	47.3%	77.8%	61.0%
Thin meconium	18	6	24
	32.7%	13.3%	24.0%
Thick meconium	11	2	13
	20.0%	4.4%	13.0%
Blood stained	0	2	2
	0.0%	4.4%	2.0%
Total	55	45	100
	100.0%	100.0%	100.0%
p value < 0.01			

Table 5: Comparison of mode of delivery across the study groups

Mode of delivery	AFI (in cm)		Total
	< / = 5	5.1 - 8	
Normal vaginal delivery	7	24	31
	12.7%	53.3%	31.0%
Instrumental delivery	8	13	21
	14.5%	28.9%	21.0%
LSCS	40	8	48
	72.7%	17.8%	48.0%
Total	55	45	100
	100.0%	100.0%	100.0%
p value < 0.01			

Table 6: Comparison of indication of LSCS across the study groups

Indication of LSCS	AFI (in cm)		Total
	< / = 5	5.1 - 8	
Fetal distress	17	2	19
	30.9%	4.4%	19.0%
Previous LSCS	12	1	13
	21.8%	2.2%	13.0%
Malpresentation	3	2	5
	5.5%	4.4%	5.0%
Non-progress of labour	4	1	5
	7.3%	2.2%	5.0%
Severe FGR	4	0	4
	7.3%	0.0%	4.0%
Abruptio placentae	0	2	2
	0.0%	4.4%	2.0%
p value < 0.01			

Table 7: Comparison of Apgar score (out of 10) at 5 minutes across study group

Apgar score	AFI (in cm)		Total
	< / = 5	5.1 - 8	
< / = 7	14	3	17
	25.5%	6.7%	17.0%
> 7	41	42	83
	74.5%	93.3%	83.0%
Total	55	45	100
	100.0%	100.0%	100.0%
p value - 0.016			

Table 8: Comparison of NICU admission across the study groups

NICU admission	AFI (in cm)		Total
	< / = 5	5.1 - 8	
Yes	14	3	17
	25.5%	6.7%	17.0%
No	41	42	83
	74.5%	93.3%	83.0%
Total	55	45	100
	100.0%	100.0%	100.0%
p value - 0.016			

References

1. Phelan JP, Smith CV, Broussard P, Small M. Amniotic fluid volume assessment using the four-quadrant technique in the pregnancy at 36-42 weeks gestation. J Reprod Med. 1987;32(7):540-2.
2. Jagatia K, Singh N, Patel S. Maternal and Fetal Outcome in Oligohydramnios maternal and fetal outcome in oligohydramnios: a study of 100 cases. Int J Med Sci Public Health. 2013;2(3):724-7.
3. Bhat S, Kulkarni V. Study of effect of oligohydramnios on maternal and fetal outcome. Int J Med and Dent Sci. 2015;4(1):582-8.
4. Magann EF, Chauhan SP, Washington W, Whitworth NS, Martin JN, Morrison JC. Ultrasound estimation of amniotic fluid volume using the largest vertical pocket containing umbilical cord: measure to or through the cord? Ultrasound Obs Gynecol. 2002;20:464-7.
5. Dubil EA, Magann EF. Amniotic fluid as a vital sign for fetal wellbeing. Australas J Ultrasound Med. 2013;16(2):62-70.
6. Gaikwad PR, Oswal MS, Gandhewar MR, Bhatiyani BR. Perinatal outcome in oligohydramnios and borderline amniotic fluid index: a comparative study.

Int J Reprod Contraception, Obstet Gynecol. 2016;55(66):1964-8.
7. Rainford M, Adair R, Scialli AR, Ghidini A, Spong CY. Amniotic fluid index in the uncomplicated term pregnancy: Prediction of outcome. J Reprod Med. 2001;46(6):589-92.
8. Chate P, Khatri M, Hariharan C. Pregnancy outcome after diagnosis of oligohydramnios at term. Int J ReprodContraceptObs Gynecol. 2013;22(1):23-6.
9. Casey BM, McIntire DD, Bloom SL, Lucas MJ, Santos R, Twickler DM, *et al*. Pregnancy outcomes after antepartum diagnosis of oligohydramnios at or beyond 34 weeks' gestation. Am J Obstet Gynecol. 2000;182(4):909-12.
10. Shrem G, Nagawkar SS, Hallak M, Walfisch A. Isolated Oligohydramnios at Term as an Indication for Labor Induction: A Systematic Review and MetaAnalysis. Fetal DiagnTher. 2016;40(3):161-73.
11. Kansal R, Bansal I, Singla D, Agrawal N, Thami G. Oligohydramnios maternal &fetal outcome in pregnant females. Asian Pac J Heal Sci. 2017;4(2):235-40
12. Rathod HM, Patel RR, Punatar PS. Maternal and perinatal outcome in oligohydramnios at Guru Gobindsinh hospital, Jamnagar, Gujarat. Int J Health Sci Res. 2014;4(9):91-96.
13. American College of Obstetricians and Gynecologists. Fetal growth restriction. Practice Bulletin No. 134. Obstet Gynecol. 2013 May;121(5):1122-33.
14. Gaur Y, Parashar H, Dhurve D. Maternal and fetal factors in pregnancy with oligohydramnios and maternal and perinatal outcome. Int J Med Health Res. 2017;3(4):13-16.
15. Ghike S, Reddy G, Ghike N. Increasing Severity of Oligohydramnios: A Risk Factor for Outcome. J South Asian Fed Obstet Gynecol. 2013:5(1):8-10.
16. Dasari P, Niveditta G, Raghavan S. The maximal vertical pocket and AF index in predicting fetal distress in prolonged pregnancy. Int J Gynaecol Obstet. 2007;96:89-93.
17. Dasari P, Niveditta G, Raghavan S. The maximal vertical pocket and AF index in predicting fetal distress in prolonged pregnancy. Int J Gynaecol Obstet 2007;96:89-93.
18. Dasari P, Niveditta G, Raghavan S. The maximal vertical pocket and AF index in predicting fetal distress in prolonged pregnancy. Int J GynaecolObstet. 2007;96:89-93.
19. Kabade KS, Laddad MM, Kshirsagar NS, Kadam D. Oligohydramnios and its correlation with maternal and perinatal outcome: A prospective observational study. Medpulse-Int Med J. 2017;4(5):636-40.
20. Guin G, Punekar S, Lele A, Khare S. A prospective clinical study of fetomaternal outcome in pregnancies with abnormal liquor volume. J ObstetGynaecol India. 2011 Dec;61(6):652-5.
21. Sriya R, Singhai S, *et al*. Perinatal outcome in patients with amniotic index ≤ 5 cm. J Obstet and Gynaecol of India. 2001;51(5):98-100.
22. Zhang J, Troendle J, Meikle S, Klebanoff MA, Rayburn WF. Isolated oligohydramnios is not associated with adverse perinatal outcomes. BJOG. 2004 Mar;111(3):220-5.
23. Shrem G, Nagawkar SS, Hallak M, Walfisch A. Isolated Oligohydramnios at Term as an Indication for Labor Induction: A Systematic Review and MetaAnalysis. Fetal DiagnTher. 2016;40(3):161-73.