RESEARCH
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TO STUDY ANTEPARTUM CARDIOTOCOGRAPHY FINDINGS IN OLIGOHYDRAMNIOS AT TERM AND ITS CORRELATION WITH FETAL OUTCOME

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Abstract
Aim: To study the antepartum cardiotocography findings in oligohydramnios at term and its correlation with fetal outcome.
Methodology: The prospective study of 60 antenatal cases of oligohydramnios at term was carried out in the department of OBG, Apollo Institute of Medical Sciences &Research center and District Head quarter Hospital, Chittoor, Andhra Pradesh . A thorough history was collected and general examination was performed upon admission. Ultrasound was used to determine the AFI. Informed consent was taken, after explaining patients regarding the procedure. In antepartum women with oligohydramnios at term at the time of admission , CTG was done and the trace was graded into normal, suspicious and pathological trace.
Results: Out of 60 patients, 53.3% had normal trace, 23.3% patients had suspicious trace, and 23.3%patients had pathological trace. Among patients with normal trace, 18 had fetal distress i.e., 56.3% . Among 14patients with suspicious trace, 12 patients had developed fetal distress i.e., 85.7%. Out of14 patients with pathological trace, 12 had fetal distress i.e., 85.7%. 46.6% of neonates in suspicious and pathological CTG trace group21.4% had Apgar <7 at 5thminute. Irrespective of APGAR score neonates required NICU admission because of meconium stained liquor and some respiratory pathology. Among 60 patients with oligohydramnios 46(76.7%) had LSCS which suggests increased operative interventions. Sensitivity of the CTG test in oligohydramnios in diagnosing fetal distress was 78.9%. Specificity of the CTG test in oligohydramnios in diagnosing fetal distress was58.5%. Positive predictive value of the CTG test in oligohydramnios in diagnosing fetal distress was 46.9%. Negative predictive value of the CTG test in oligohydramnios in diagnosing fetal distress was 85.7 %.
Conclusion: CTG test in oligohydramnios at term was useful in decreasing the neonatal morbidity by early intervention in suspicious & pathological CTG traces as in this study.
Keywords: CTG, Oligohydramnios, Antepartum, Meconium, APGAR

INTRODUCTION

Amniotic fluid, secreted by amnion a 2 layer extra embryonic membrane formed by inner ectoderm and outer somatic mesoderm providing fluid medium for development of embryo, protecting from concussion, pressure.

Amniotic fluid serves as a cushion for the fetus, providing protection and sustenance. It prevents infections with its bacteriostatic characteristics. Also serves as a key source of embryonic nutrition. The volume of amniotic fluid grow to around 30 ml at 10 weeks,200ml at 16 weeks,800ml at mid-third trimester, and 1000ml at 37 weeks. The volume of amniotic fluid drops by 8% per week after 40weeks, and drops to 400ml at 42weeks.1oligohydramios is a clinical condition characterized by decreased amniotic fluid volume.

The reduced amount of amniotic fluid volume is often one of the first clues to an underlying fetus pathology or maternal disease. Incidence of oligohydramnios is 3.9% of all the pregnancies. 2

Oligohydramnios is a common finding in FGR there is strong association between decreased amniotic fluid volume and the incidence of FGR in the study by Chamberlain and coworkers, the incidence of FGR when AFI was normal is 5% but when oligohydramnios was present, it increased approximately to 40%.The cause of oligohydramnios seen in FGR babies is decreased fetal urine output secondarily to redistribution of the fetal blood flow with decreased renal perfusion and preferential shunting to the brain. 3

The etiology for oligohydramnios is multifactorial. In the second trimester, it is mainly due to preterm premature rupture of membranes (PPROM), fetal urinary tract abnormalities and FGR. In the third trimester it is mainly due to PPROM. Severe and early onset oligohydramnios can result in postural abnormalities in the fetus and pulmonary hypoplasia. In the present study we are studying oligohydramnios at term gestation 37 wks to 42 wks. 4

In this study antepartum cardiotocography findings of oligohydramnios at term gestational age were correlated with fetal outcome. CARDIOTOCOGRAPH MACHINE Cardiotocography (CTG) records fetal heart rate and fetal

movement with or without uterine contraction for 20 min during pregnancy. The machine used to perform the monitoring is called cardiotocography, also known as electronic fetal monitor (EFM).

AIMS AND OBJECTIVES

To study the antepartum cardiotocography findings in oligohydramnios at term and correlation with fetal outcome

• To study antepartum cardiotocography findings in oligohydramnios at term.

• To study fetal outcome in oligohydramnios at term.

MATERIAL AND METHODS

STUDY DESIGN:

The prospective study of 60 antenatal cases of oligohydramnios at term was carried out in department of OBG Apollo Institute of Medical Sciences &Research center and District Head quarter Hospital, Chittoor, Andhra Pradesh,.

PERIOD OF STUDY: November 2022 – February 2023.

This study was conducted after obtaining clearance from ethics committee. An informed consent was taken and signed by the patients before recruitment.

SELECTION OF PATIENT:

Inclusion criteria:

Antenatal women with clinical diagnosis of oligohydramnios, usg showing AFI <5 at term with gestational age 37 weeks to 42 weeks.

Exclusion criteria:

Multiple pregnancy

Normal pregnancy without oligohydramnios, Diagnosed intrauterine death (IUD), Antepartum hemorrhage

Congenital malformed fetus.

Sample size: 60

METHODS

Patient preparation:

• Patient is counseled regarding the procedure.

• Bladder should be emptied.

• Test is done after a meal.

Position of patient:

Patient is laid on bed in left lateral position. The objective is to displace the uterus from inferior vena cava minimizing aortocaval compression.

Procedure:

Ultrasound transducer is applied on the maternal abdomen where fetal heart rate is most distinctly heard after applying jelly. Tocodynamometer is placed over the uterine fundus. The belts should be tied not too tight or loose and should be comfortable. The event marker is held by patient and asked to press the button with each fetal movement.

Figure 1 :Recording of a CTG trace

Cardiotocography

The test is performed in patients with oligohydramnios at term with USG showing AFI <5, for a period of 20 minutes.

If the test is not reassuring by 20 minute, test has to be continued for another 20 min to exclude possibility of fetal sleep.

Now the CTG trace is interpreted and categorized based on definition and guidelines of ACOG & NICE into 3 categories

• Normal CTG trace.

• Suspicious CTG trace.

• Pathological CTG trace.

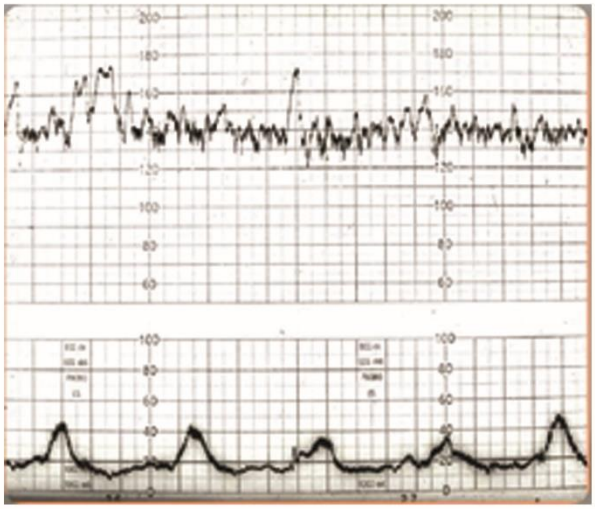

Figure 2 :showing Normal CTG -reactive

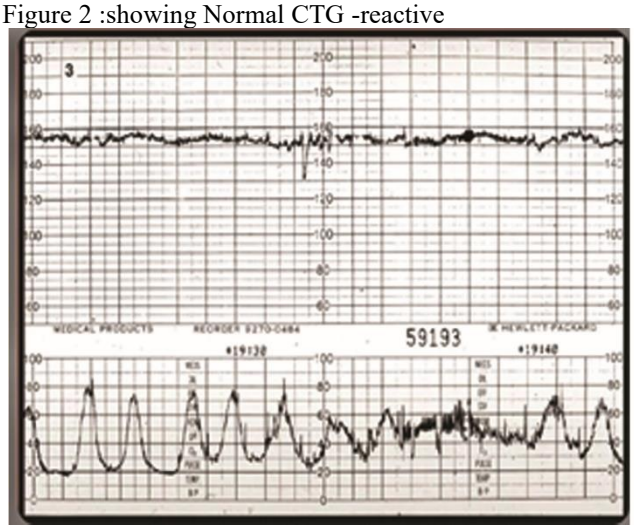

Figure 3: pathological CTG – reduced variability

Measurement of outcome done in terms of

• Need for emergency LSCS

• Incidence of meconium stained liquor

• APGAR score <7

• Need for NICU admission.

In patients with suspicious CTG trace, a 20 minutes extended strip was taken after the necessary measures:

Place in left lateral position. Stop uterine stimulants.

Check per vaginal examination. Oxygen and fluid supplementation.

The CTG trace now obtained is again categorized into normal, suspicious or pathological.

Intermittent auscultation was performed on patients who had a normal admission CTG trace. Continuous electronic monitoring was used to keep track of patients who had persistently doubtful admission CTG trace. In patients who had an abnormal CTG trace prompt intervention was given.

When pathological FHR alterations were seen and resulted in LSCS or instrumental delivery , the Apgar score of these new borns were observed to be low at birth.

CTG trace results were correlated with following criteria.

Type of delivery,, birth weight ,fetal distress and NICU admissions of the newborns.

STATISTICAL ANALYSIS

The present study has been evaluated with descriptive statistical method. Chi-square test has been used to find the importance of study parameters on categorical scale between two or more groups. Chi-square test is used to correlate CTG findings with liquor color, NICU admissions, Apgar score, birth weight of neonates at birth.

Significant figures

+ Suggestive significance (p value: 0.05<p<0.10)

* Moderately significant (p value: 0.01<p<0.05)

** Strongly significant (p value<0.01)

Statistical analytical data

Data was analyzed with Microsoft excel and SPSS (Statistical package for social sciences) version 25. Statistical analysis was done by using Chi-square test. Results were expressed in terms of mean and percentages. P value <0.05 was considered as statistically significant.

RESULTS & OBSERVATIONS

Table 1: Age-wise distribution of study population

Age distribution (in years)	Frequency	Percentage (%)
≤20	10	16.7
21-25	38	63.3
26-30	10	16.7
31-35	2	3.3
Total	60	100

Mean age of study population was 23.13±3.1.

Majority of patients in this study belongs to age group of 21-25 years with 63.3%

Table 2: Distribution of study population based on parity

Gravida	Frequency	Percentage (%)
Gravida 1	25	41.7
Gravida 2	30	50.0
Gravida 3	4	6.7
Gravida 4	1	1.7
Total	60	100

Table 3: Distribution of study population based on baseline variability

Baseline variability	Frequency	Percentage (%)
Good	28	46.7
Minimal	10	16.7
Moderate	22	36.7
Total	60	100

46.7% had good base line variability, 16.7% had minimal baseline variability, and 36.7% had moderate variability.

Table 4: Distribution of study population based on interpretation of CTG

INTERPRETATION OF CTG	Frequency	Percentage (%)
Normal	32	53.3
Abnormal	28	46.7
Total	60	100

46.7% had abnormal CTG outcome on admission in oligohydramnios antenatal women at term

Table 5: Distribution of study population based on CTG outcome in oligohydramnios.

Outcome of CTG trace		Frequency	Percentage (%)
Normal		32	53.3
Abnormal	Suspicious	14	23.3
	Pathological	14	23.3
Total		60	100

Out of 46.6% of abnormal CTG trace 23.3% had suspicious trace and 23.3% had pathological trace.

Table 6: Distribution of study population based on type of delivery

Type of delivery	Frequency	Percentage (%)
LSCS	46	76.7
NVD	14	23.3
Total	60	100.0

76.7% of study population underwent LSCS and 23.3% had NVD.

Table 7: Distribution of study population based on Colour of liquor

Color of liquor	Frequency	Percentage (%)
Clear	33	55
Thick meconium stained liquor	5	8.3
Thin meconium stained liquor	22	36.7
Total	60	100.0

8.3% had liquor with thick meconium and 36.7% had liquor with thin meconium.

Table 8: Distribution of study population based on birth weight

Birth weight	Frequency	Percentage (%)
<2.5kgs	8	13.3
≥2.5kgs	52	86.7
Total	60	100

Mean birth weight of the neonates was 1.87 ± 0.343

Table 9: Distribution of study population based on APGAR at 1 minute

APGAR at 1 minute	Frequency	Percentage (%)
<7	16	26.7
<7	44	73.3
Total	60	100

Distribution of study population based on APGAR at 1 minute 73.3% had Apgar score >7 at 1minute

Table 10: Distribution of study population based on APGAR at 5 minutes

APGAR at 5 minute	Frequency	Percentage (%)
<7	3	50
<7	57	95
Total	60	100

Distribution of study population based on APGAR at 5 minutes Only 5% had APGAR score <7 at 5 minutes

Table 11: Distribution of study population based on NICU admission

NICU admission	Frequency	Percentage (%)
Yes	42	70
No	18	30
Total	60	100

Table 12: Association between outcome of CTG trace and type of delivery

Outcome of CTG Trace	Type of delivery		Total
	LSCS	NVD	
Normal CTG	19 (57.6%)	14(42.4%)	32(55%)
Suspicious CTG	14(100%)	0(0%)	14(23.3%)
Pathological CTG	14(100%)	0(0%)	14(21.7%)
Total	46(76.7%)	14(23.3%)	60(100%)

Chi-square test 60.0; P value 0.0001(highly Significant)

Table 13: Association between outcome of CTG and Colour of amniotic fluid

Outcome of CTG	**Color of Amniotic fluid**			**Total**
	Clear	**Thick**	**Thin**	
Normal	26 (81.2%)	0(0%)	6(18.8%)	32(53.3%)
Suspicious	5(35.7%)	1(7.1%)	8(5.71%)	14(23.3%)
Pathological	2(14.3%)	4(28.6%)	8(5.71%)	14(23.3%)
Total	33(55%)	5(8.3%)	22(36.7%)	60(100%)

Chi-square test 24.955; P value 0.0001 (Highly Significant)

28.6% of pathological CTG trace had meconium stained liquor (MSL) of thick stained and 5.7% had meconium stained liquor(MSL) of thin stained. 7.1% of suspicious CTG trace had MSL of thick stained and 5.71% had MSL of thin stained.

Table 14: Association between outcome of CTG and birth weight

Outcome of CTG	**Birth weight**		**Total**
	<2.5kgs	**≥2.5kgs**	
Normal	4 (12.5%)	28(87.5%)	32(53.3%)
Suspicious	3(21.4%)	11(78.6%)	14(23.3%)
Pathological	1(7.1%)	13(92.9%)	14(23.3%)
Total	8(13.3%)	52(86.7%)	60(100%)

Chi-square test 1.277; P value 0.528 (Non-Significant) 7.1% of pathological CTG trace had birth weight<2.5kgs only and 92.9% had birth weight >2.5kgs. 21.4% of suspicious CTG trace had birth weight <2.5kgs and 78.6% had birth weight >2.5kgs.

Table 15: Association between outcome of CTG and Apgar score at 1stminute

Outcome of CTG	**APGAR score at 1st minute**		**Total**
	<7	**> 7**	
Normal	2 (6.3%)	30(93.8%)	32(53.3%)
Suspicious	6(42.9%)	8(57.1%)	14(23.3%)
Pathological	8(57.1%)	6(42.9%)	14(23.3%)
Total	16(26.7%)	44(73.3%)	60(100%)

Chi-square test 15.347; P value 0.0001 (Highly Significant)

Table 16: Association between outcome of CTG trace and Apgar score at 5th minute

Outcome of CTG	**APGAR score at 5th minute**		**Total**
	<7	**> 7**	
Normal	0 (0%)	32(100%)	32(53.3%)
Suspicious	0 (0%)	14(100%)	14(23.3%)
Pathological	3(21.4%)	11(78.6%)	14(23.3%)
Total	3(5%)	57(95%)	60(100%)

21.4% of pathological CTG trace had Apgar score<7 and78.6% had Apgar score>7 at 5 minutes.

Table 17: Association between outcome of CTG trace and NICU admission

Outcome of CTG	**NICU admission**		**Total**
	Needed	**Not needed**	
Normal	18 (56.3%)	14(43.8%)	32(53.3%)
Suspicious	12 (85.7%)	2(14.3%)	14(23.3%)
Pathological	12 (85.7%)	2(14.3%)	14(23.3%)
Total	42(70%)	18(30%)	60(100%)

85.7%of pathological CTG trace needed NICU admission and 85.7% of suspicious CTG trace also needed NICU admission.

Table 18: Sensitivity, specificity, PPV, NPV of admission test in diagnosing fetal distress

Parameter	**Test result**
Sensitivity	78.9%
Specificity	58.5%
Positive predictive value (PPV)	46.9%
Negative predictive value (NPV)	85.7%

DISCUSSION:

The study included 60 antenatal women, diagnosed oligohydramnios at term who were admitted in labour ward of AIMSR Chittoor. If admission test is suspicious, CTG repeated 5-6 hrs, after ensuring adequate hydration and oxygenation.

32 patients had normal admission test,14patients had suspicious CTG trace, and 14 had pathological CTG trace.53.3% had normal CTG trace and 46.7% had abnormal CTG trace. A total of 60 patients 14(23.3%) had NVDS and 46(76.7%) had LSCS. In this study 55% had clear liquor and 8.3% had liquor with thick meconium and36.7% had liquor with thin meconium. Out of 32 patients with normal CTG only 6 had meconium stained liquor of thick stained, 26 patients had clear liquor. Out of 14 patients with suspicious CTG trace 5 had clear liquor, 1 had liquor with thick meconium, and 8 patients had liquor with thin meconium. Out of 14 patients with pathological CTG trace 2 patients had clear liquor, 4 patients had liquor with thick meconium and 8 patients had liquor with thin meconium.

To know the association between outcome of admission CTG trace and colour of liquor, chi-square test is applied and test has value of 24.95 with p value of 0.0001, which has high significance.

Out of 32(53.3%) patients 28 patients with normal (CTG trace (87.5%) had birth weight >2.5 kgs and 4(12.5%) had <2.5 kgs. Among 14 (23.3%) patients with suspicious CTG trace 3 (21.4%) had birth weight<2.5 kg and 11 (78.6%) had birth weight >2.5kgs.

Among 14 (23.3) patients with pathological CTG trace ,1 (7.1%) had birth weight <2.5kgs and 13 (92.9%) had birth weight>2.5kgs.

In this study the sensitivity was 78.9%. In the research through Ingemarsson et al and Blix E et al the sensitivity was 23.5% and 15% respectively. Kamal Buckshee study demonstrates the sensitivity was 21.43%. Thus, admission CTG test has a low sensitivity and high specificity.

In the present study, cardiotocography test in oligohydramnios at term showed sensitivity of 78.9%, specificity of 58.5%, positive predictive value of 46.9% and negative predictive value of 85.7%. With high sensitivity, and low specificity, its low cost and convenience of use justify its use as admission test for fetal outcome prediction. British guidelines do not recommend labour admission test in low risk people, based on 3 studies. 5,6,7 While Swedish guidelines suggest labour admission test in all antenatal women, based on seven studies.8

In this study we don't have low birth weights babies in oligohydramnios at term, which suggests late oligohydramnios doesn't have much effect on birth weight.

A similar study was done by Conway DL et al 9 found no significant difference of birth weights and term of gestational age between isolated oligohydramnios and normal pregnancy with 183 subjects in each group.33 Combining CTG with Doppler sonography in high risk cohorts had reduced perinatal mortality 30%.

A study was done to evaluate the effect of Oligohydramnios on fetal outcome in view of fetal distress, liquor with meconium stained, birth weight, Apgar score of newborn babies, NICU admission, early newborn diseases and deaths. The emergency Caesarean section rate for fetal distress was 41%. Liquor with meconium stained was found in 30.7% patients.10 In our study LSCS rate was 76.7% and liquor with thick meconium stained was 8.3%, liquor with thin meconium stained was 36.7%.

Casey &Co-workers studied pregnancy outcomes, in oligohydramnios at or above 34 weeks gestation in 147 cases in comparison with normal pregnancies and found that oligohydramnios was associated with increase in labour induction(42% vs 18%), Non reassuring heart rate(48% vs 39%), NICU admission (7% vs 2%), liquor with meconium stain(1 0/o vs 0.1%),neonatal death rate (5% vs 0.3%).11In this study 46% had Abnormal CTG,70% had NICU admissions,44% had meconium stained liquor.

A prospective and observational study was done in a private specialized hospital at Dhaka city ,78 singleton pregnant women of gestational age from 28 - 42 weeks with less Amniotic fluid index (AFI) were analysed for perinatal outcome. Women with oligohydramnios were absolutely associated with an abnormal fetal heart rate (FHR), liquor with meconium stained, Apgar score less than 7 or NICU admission and higher rate of caesarean sections.12

The current study found a 56.3% incidence of fetal distress in normal CTG trace group, In this study the Normal CTG trace group fails to detect fetal distress in 56.3% of patients. As a result the normal CTG trace was shown to be false negative in 56.3% of cases when it comes to predict fetal distress.

In the present study the incidence of fetal distress in the suspicious CTG trace group was 85.7%which is comparable to studies by Krebs et al. 13

According to preceding statistics, the incidence of fetal distress increases when the normal CTG trace advances from suspicious to pathological trace. We can observe that the incidence of fetal distress is increasing as the normal CTG trace progresses towards a pathological trace. As a result a CTG test at admission can detect fetal distress which is present upon admission and necessary intervention can be done as soon as possible with continuous monitoring. Newborns were attended by the paediatrician dry stimulation was enough in the babies of isolated oligohydramnios at birth, while some of the babies in IUGR group needed resuscitation and NICU admissions.

Youseef et al studied fetal outcome in term pregnancies with AFI < 5 cm and found that AFI is superior in detecting fetal outcome.14

Locatelli studied perinatal outcome associated with oligohydramnios in uncomplicated term pregnancies and concluded that oligohydramnios independently associated with a higher risk of low birth weight percentile.15 Where as in our study we don't have significance with low birth weight babies at term isolated oligohydramnios. Casey and colleagues(2000) found that an AFI < 5 cm complicated 2% of pregnancies undergoing sonography at parkland hospital after 34 weeks gestation.

Petrozella and associates (2011) similarly reported that an AFI < 5 cm identified between 24 to 34 weeks was associated with increased risks of stillbirth, spontaneous or medically induced preterm birth, fetal heart rate pattern abnormalities and fetal growth restriction (FGR).16

When thick meconium is combined with an abnormal fetal heart rate pattern, a poor fetal outcome has been documented.12 out of 14 patients with MSL with abnormal CTG trace in this study exhibited fetal distress. When the CTG trace is abnormal we must be vigilant and take immediate action.

The admission CTG test had high correlation Apgar score at 5 min Apgar score 83.6% of new born with Apgar score>7 followed the reactive trace. Admission CTG testing with abnormal CTG trace is not able to predict poor fetal outcome in just 4.63% of cases only.

According to the results of this study, an alarming admission CTG test should be dealt promptly, and obstetricians should be more cautious in the suspicious and pathological CTG test groups by doing continuous or intermittent monitoring for early interventions.

LIMITATIONS OF THE STUDY

Only 60 cases of oligohydramnios are studied.

The diagnosis of fetal distress is made by FHR tracings. Use of other fetal surveillance methods like fetal scalp blood sampling, acoustic stimulation, and amnioinfusion would have altered the outcome. Lack of neonatal follow up after one week.

CONCLUSION:

The main goal of antepartum cardiotocography is to identify fetus with on going hypoxia, that will benefit early intervention.It is recommended for fetal surveillance in high-risk pregnancies, although cardiotocography changes appear late in the course of progressive placental insufficiency. Antepartum cardiotocography has a high negative predictive value ,i.e. a normal tracing almost excludes the occurrence of ongoing fetal hypoxia.

The use of CTG test for oligohydramnios cases which require continuous monitoring in obstetric patients were studied.It aims to investigate the tests to detect or predict fetal distress at the time of admission in the labour room. In this study cardiotocography as an admission test had a sensitivity of 78.9% and a specificity of 58.5%.it can detect fetal distress that has a already occurred at time of admission. It is a simple test, and can be performed quickly and is useful alternative to intermittent auscultation or continuous monitoring in low resource settings. A reassuring trace has low risk of fetal distress as indicated by Apgar score, while a pathological tracing is linked to high risk of fetal distress. The early intervention helped to reduce infant mortality in this study in patients with abnormal CTG trace. According to the findings in the study, auspicious and the pathological CTG test should be handled promptly by the obstetricians.

Conflict of Interest
None
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References
1. Cunningham, Leveno, Bloom, Dashe, Hoffman, casey ,Spong Disorders of Amniotic Fluid Volume. In: Williams Obstetrics 25th edition. United state of America: McGrawHill; 2010. Page 230.
2. RenuMisra. Hydramnios and Oligohydramnios. In:Ian Donald' practical obstetric problems.7 th edition. NewDelhi:B I Publications Pvt Ltd; 2012 . page 380.
3. Magann EF, Kinsella MJ, Chauhan SP, McNamara IVIF, Gehring BW, Morrison JC. Does an amniotic fluid index of < 5 affect the outcome. Am J ObstetGynecol ;1999:180.
4. Sherer DM. A review of amniotic fluid dynamics and the enigma of isolated oligohydramnios. Am JPerinatoi 2002; 19: 253-66.
5. Ingemarsson I, Arulkumaran S, Ingemarsson E, Tambyraja RL, Ratnam SS. Admission test: a screening test for fetal distress in labour. ObstetGynecol 1986 Dec; 68(6): 800-6
6. Umstad MP. The predictive value of abnormal fetal heart rate patterns in early labour. Aust N Z J ObstetGynaecol 1993; 33: 145-149.
7. Kulkarni AA, Shrotri AN. Admission test: a predictive test for fetal distress in high risk labour. J ObstetGynaecol Res 1998; 24: 255-259.
8.Sarno AP, Jr., Phelan JP, Ahn MO. Relationship of early intrapartum fetal heart rate patterns to subsequent patterns and fetal outcome. J Reprod Med 1990; 35: 239-242.
9. Conway DL, Groth s, Adkins WB et al. Management of Isolated decreased AFI in term pregnancy: A randomized clinical trial. Am J ObstetGynecol2000.; S 21:182.
10. CHAUDHARI, Kamlesh R.; CHAUDHARI, Kushagra R.; DESAI, Omkar M.. Perinatal outcome associated with oligohydramnios in third trimester. International Journal of Reproduction, Contraception, Obstetrics and Gynecology, [S.l.], v. 6, n. 1, p. 72-75, dec. 2016. ISSN 2320-1789.
11. Casey BM. Pregnancy outcomes after antepartum diagnosis of oligohydramnios at or beyond 34 weeks' gestation. Am JObstetGynecol 2000;182: 909-12.
12. NathJayati, et al. "A clinical study on oligohydramnios in the third trimester of pregnancy with special emphasis on the perinatal outcome." Journal of Evolution of Medical and Dental Sciences, vol. 2, no. 39, 30 Sept. 2013, pp. 7386+. Gale Academic
13. Krebs HB, Petres RE, Dunn LJ, Smith PJ. Intrapartum fetal heart rate monitoring: Prognostic significance of accelerations. Am J ObstetGynecol 1982; 142:297-305.
14. Youssef AA, Abdulla SA, Sayed EH, et al. Superiority of amniotic fluid index over amniotic fluid pocket measurement for predicting bad fetal outcome .South MedJ 1993;86:426-9.
15. 1.Locatelli Anna et al. Archives of Gynecology and Obstetrics, Jan2004; 269(2): page no 125.
16. Petrozella, Loren N. MD, Dashe, Jodi S. MD, Mclntire, Donald D. PhD, Leveno, KennethJ. MD Vol. 7, No. 4 , Pages 197-200.