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RESEARCH ARTICLE

STUDY OF RELATIONSHIP OF DAILY FETAL MOVEMENT COUNT, AMNIOTIC FLUID INDEX, COLOUR DOPPLER WITH PERINATAL OUTCOME"

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Abstract

Background: In 2015 there were 2.6 million stillbirths globally, with more than 7178 deaths a day. Because more than 75% fetal death occur before the onset of labor and IUGR constitutes 5% of perinatal morbidity and mortality, it would be essential to extend the principle of intrapartum fetal heart rate monitoring to the antepartum period in an effort to prevent these fetal deaths and morbidity. Here comes the importance of Antepartum Fetal Surveillance (AFS). Antepartum Fetal Surveillance (AFS) is the assessment of fetal wellbeing in utero before the onset of labour. The main aim of antepartum fetal surveillance is to reduce perinatal mortality and morbidity and to avoid fetal death. Methods It is Prospective study conducted in Department of Obstetrics and Gynaecology, M.G.M. Medical College and M.Y. Hospital, Indore (M.P.) during the period from April 2015 to March 2016. The study has been started after the approval of topic by ethical and scientific review committee of MGM MEDICAL College, Indore. Results All the three seen to have significant correlation with perinatal outcome.

Conclusion: In our study, all the three indices when abnormal were significantly associated with poor perinatal outcome. DFMC seen to be highly sensitive with more than half of the still births reporting with chief complaint of loss of fetal movements. So it can be considered as the earliest marker of fetal wellbeing with Color Doppler being highly specific predictor for early detection of IUGR.

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Introduction:-

In 2015 there were 2.6 million stillbirths globally, with more than 7178 deaths a day. Because more than 75% fetal death occur before the onset of labor and IUGR constitutes 5% of perinatal morbidity and mortality, it would be essential to extend the principle of intrapartum fetal heart rate monitoring to the antepartum period in an effort to prevent these fetal deaths and morbidity. Here comes the importance of Antepartum Fetal Surveillance(AFS). Antepartum Fetal Surveillance (AFS) is the assessment of fetal wellbeing in utero before the onset of labour. The main aim of antepartum fetal surveillance is to reduce perinatal mortality and morbidity and to avoid fetal death. Antepartum fetal surveillance techniques based on assessment of fetal heart rate patterns have been in clinical use for almost three decades in women who have risk factors for uteroplacental insufficiency and other cause including hydrops fetalis, intrauterine infection, cord accident and others high risk pregnancies and for pregnancies complicated with medical disorders.

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Pregnancy-related conditions
Pregnancy-induced hypertension ,Decreased fetal movement ,Oligohydramnios ,Polyhydramnios,Intrauterine growth restriction ,Post term pregnancy ,Isoimmunization (moderate to severe) ,Previous fetal demise (unexplained or recurrent risk ,Multiple gestation (with significant growth discrepancy)

Maternal conditions
Hypertensive disorders,Anti phospholipid syndrome,Hyperthyroidism (poorly controlled) ,Hemoglobinopathies (hemoglobin SS, SC, or S-thalassemia),Cyanotic heart disease ,Systemic lupus erythematosus ,Chronic renal disease andType 1 diabetes mellitus

An ideal test for assessing the antepartum fetus would allow intervention before fetal death or asphyctic damage. Before the availability of such tests, the only method for attacking this problem was to prematurely deliver such foetuses based on empirical risk data, as in the Priscilla White for managing diabetics. The problem with such an approach is twofold. The morbidity and mortality from premature intervention often exceed those of the original risk factor. It would be preferable to treat the disease process and allow the fetus to go to term.

Several biochemical tests have been proposed to evaluate the antepartum fetus. Historically these include maternal estriol, human placental lectogen, diamine oxidase and heat stable alkaline phosphatase.

Now a days antepartum fetal surveillance is widely integrated into clinical practice in the developed world. Several antepartum fetal surveillance techniques (tests) in use include Daily fetal movement count, NST, contraction stress test (CST), BPP, modified BPP, and umbilical artery Doppler velocimetry. These can identify the fetus that is either suboptimally oxygenated or, with increasing degrees of placental dysfunction. Fetal heart rate pattern level of activity, and degree of muscular tone are sensitive to hypoxemia and acidemia (1–4).Also there occurs redistribution of fetal blood flow in response to hypoxemia which may result in diminished renal perfusion and thereby oligohydramnios.[5]

So identification of suspected fetal compromise provides the opportunityto intervene before progressive metabolic acidosis can lead to fetaldeath.
This thesis is subject of discussion of three basic antenatal fetal surveillance factors i.e., DFMC, AFI AND COLOR DOPPLER during the antenatal period starting from 28 weeks in both normal and high risk pregnancies and their correlation with perinatal outcome. It reviews the science behind, the clinical evidence for, and the effectiveness of these surveillance methods as per today.

Aims and Objectives:-
To Study the relationship of Daily Fetal Movement Count, Amniotic fluid Index, Color Doppler with perinatal outcome.

To detect the earliest marker of fetalwell being.

Early detection of fetal growth restrictions and its appropriate management.

Antenatal fetal assessment to decrease the perinatal mortality.

To compare perinatal outcome in normal and high risk (Oligo & Poly) pregnancies.

Materials & Methods:-
The present study entitled **"TO STUDY THE RELATIONSHIP OF DFMC, AFI & COLOR DOPPLER WITH PERINATAL OUTCOME"** is conducted in the Department of Obstetrics and Gynaecology, M.G.M. Medical College and M.Y. Hospital, Indore (M.P.) during the period from April 2015 to March 2016. The study is approved by the Ethics Committee of M.G.M. Medical College and M.Y. Hospital, Indore (M.P.). Each patient was told about her inclusion and participation in this study and her informed consent is taken.

Study Design:
Prospective study.

Study Period:
1 year from the date of approval of study.

Study Centre:
Department OF Obstetrics and Gynaecology of M.G.M Medical College and M.Y. Hospital Indore.

The study has been started after the approval of topic by ethical and scientific review committee of MGM MEDICAL College, Indore.

Inclusion criteria
1. Antenatal women above 28wks of gestation period attending Antenatal OPD in MYH Indore.
2. Those with high risk factors and those with previous history of stillbirth.
3. Patients those who give consent.

Exclusion criteria
1. Antenatal women below 28 weeks of gestation period attending Antenatal OPD in MYH Indore.
2. Patients who have IUD at presentation.
3. Multiple pregnancies, those on any kind of medications.
4. Patients those who do not give consent.

In every case detail history will be taken & thorough examination (general, systemic and obstetrical) will be done. High risk factors assessed.

Routine investigations :-
CBC, Blood Group, BT/CT will be sent, RFT, LFT.

Special investigations:-
Ultrasonography (Amniotic fluid index), Color Doppler.

Three indices are studied in each patient, DFMC assessed as per "Cardiff count of Ten" method and categorized as normal if more than 10 in 12 hours, decreased if less than 10 in 12 hours. and loss of fetal movements, AFI <5 categorised as oligohydramnios, AFI 5–24 categorised as adequate, AFI >24 categorised as polyhydramnios, Color Doppler in terms of normal and abnormal Doppler flow in both MCA and UA .

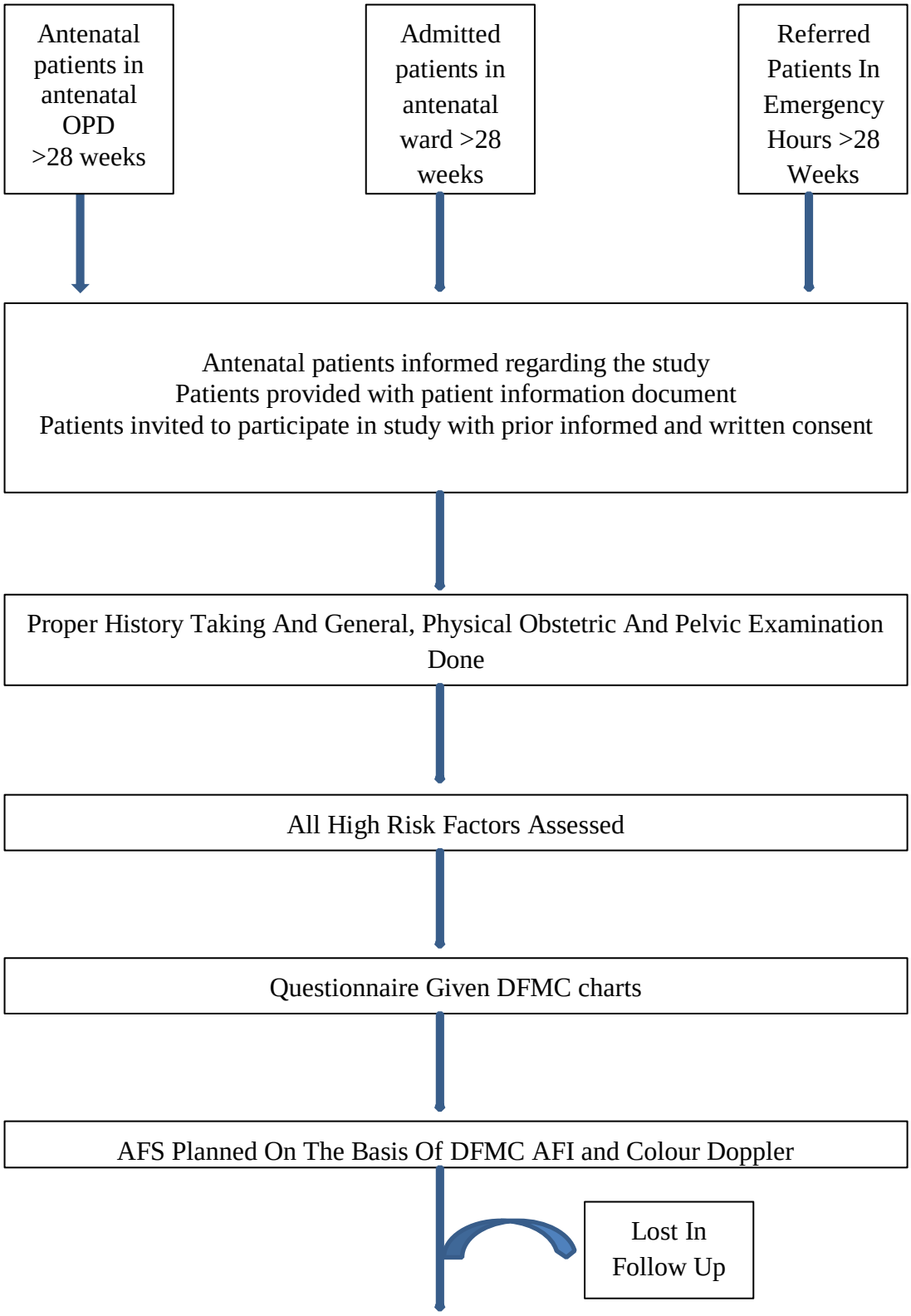
Statistical Analysis:
Statistical analysis has been carried out in the present study.

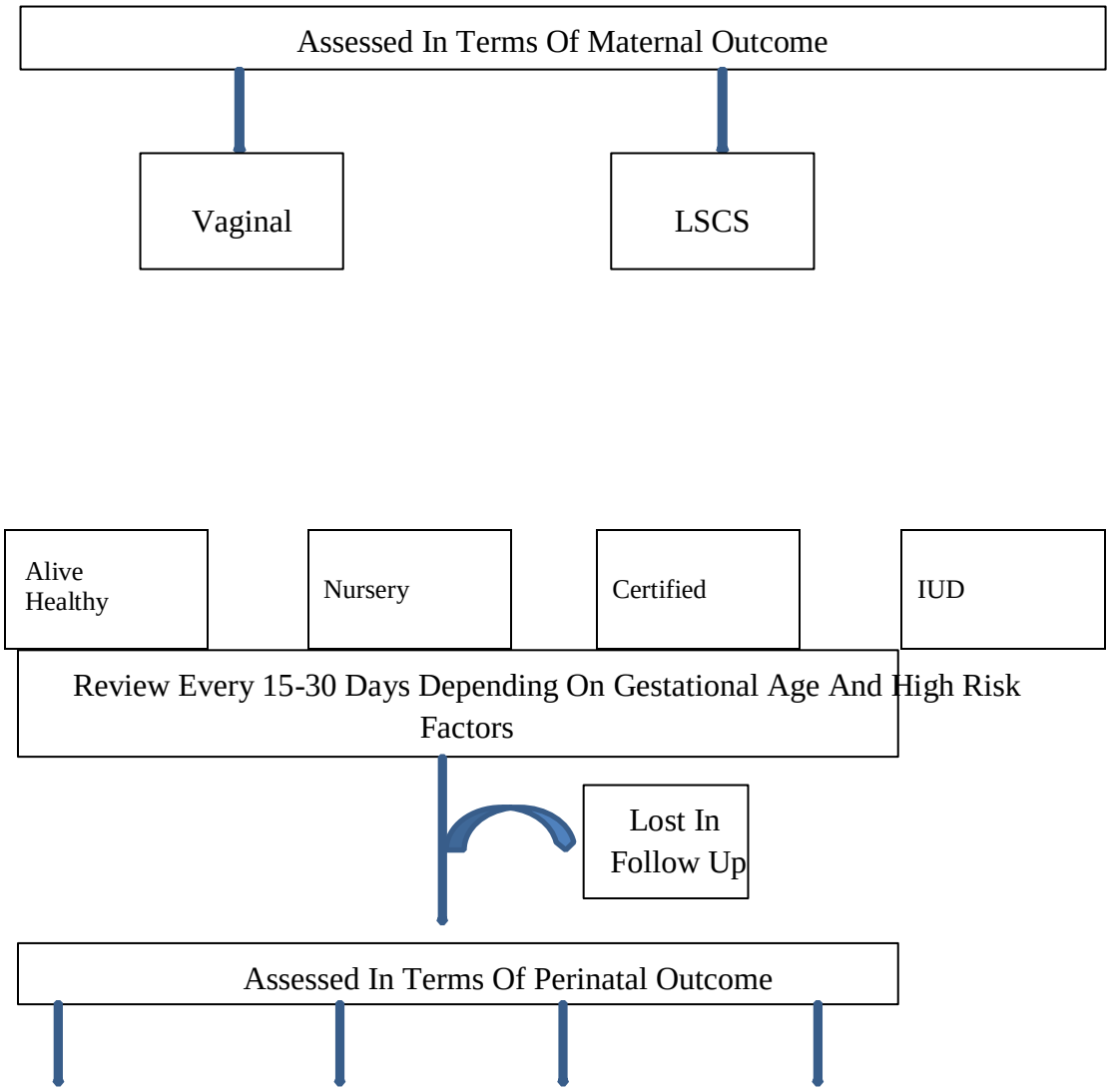
Results on continuous measurements are presented on Mean±SD (MinMax) and results on categorical measurements are presented in Number (%).

Significance is assessed at 5% level of significance. Chi-square test has been used to find the significance of study parameters. The Statistical software SPSS 19.0 version has been used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

Methodology:-

300 Cases



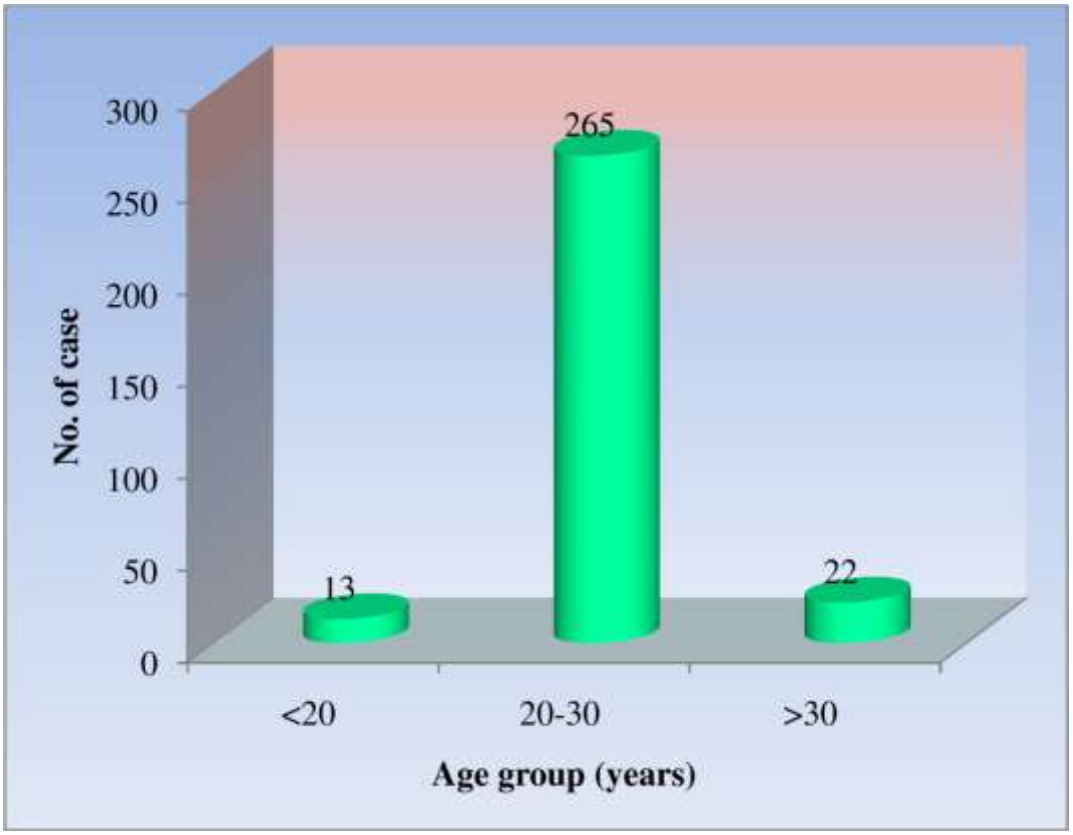


Observations & Results:-

Table 1:- Distribution of Patients as per Age.

Age (years)	Number of Cases	Percentage
<20	13	4.33%
20-30	265	88.33%
>30	22	7.34%
Total	300	100%

In this study majority 88.33% of study patients belong to age group of 20-30 years with Mean age group of study cases 24.94+2SD.



Graph 1:- Distribution of Patients as per Age.

Table 2:- Distribution of Patients as per Education.

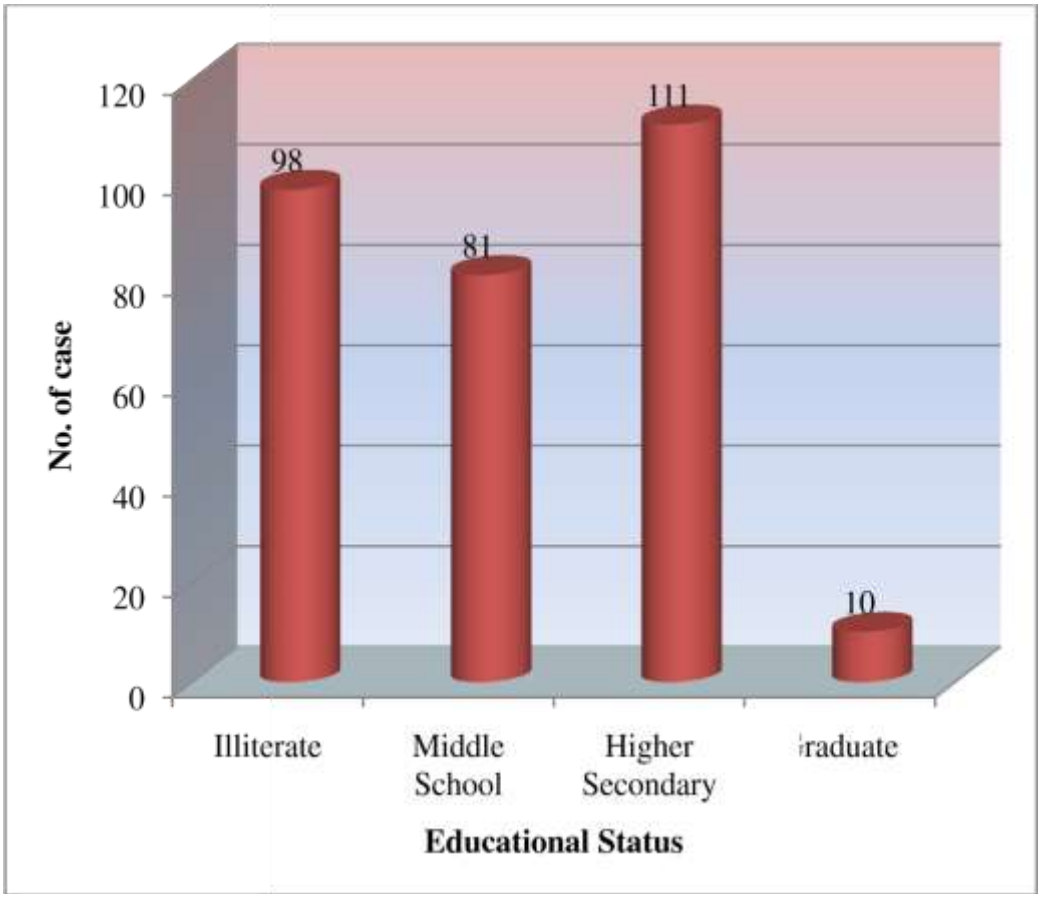
Education	Number of Cases	Percentage
Illiterate	98	32.67
Middle School	81	27.00
Higher Secondary	111	37.00
Graduate	10	3.33
Total	300	100%

The above table shows that about 1/3 of patients i.e., 32.6% patients of study group were illiterate.

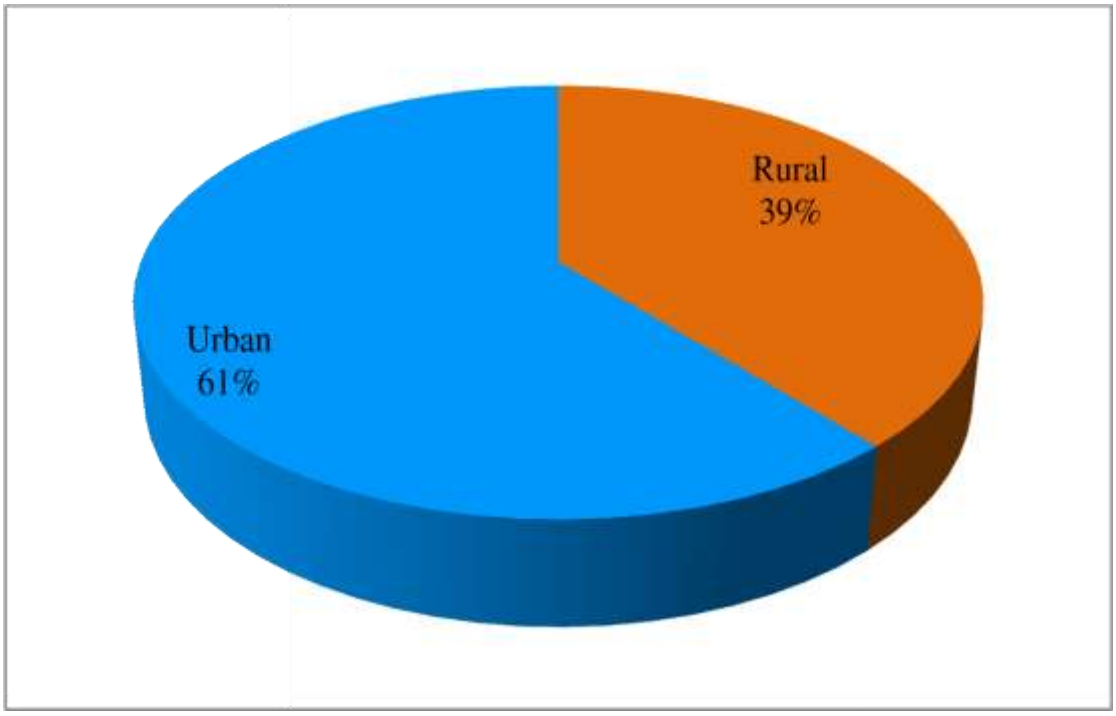
Table 3:- Distribution of Patients as per Residential Status.

Residential Status	Number of Cases	Percentage
Rural	116	38.67%
Urban	184	61.33%
Total	300	100%

The above table shows distribution of patients as per residential status, out of which rural population constitutes 38.6%.



Graph 2:- Distribution of Patients as per Education.

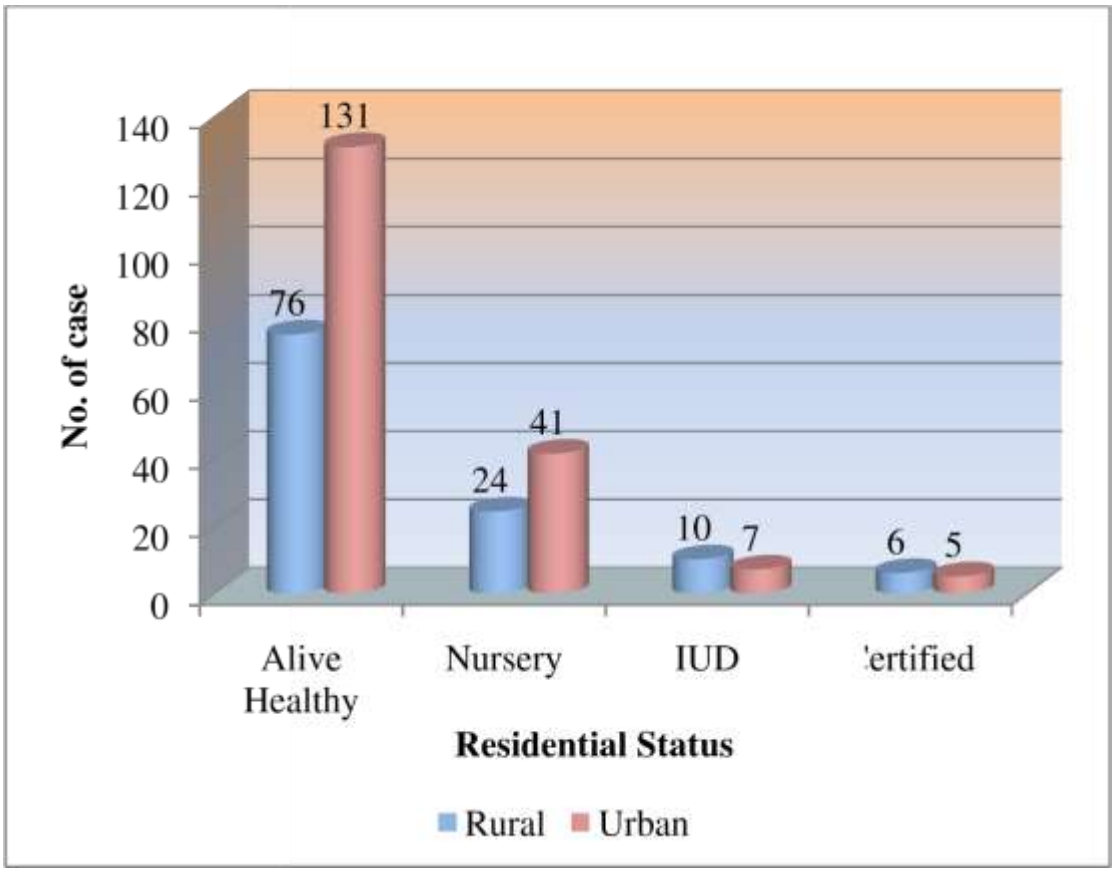


Graph 3:- Distribution of Patients as per Residential Status.

Table 4:- Perinatal Outcome in relation to Residential status.

Residential Status	Alive Healthy	Nursery	Certified	IUD	Total
Rural	76(65.5%)	24(20.7%)	06(5.2%)	10(8.6%)	116
Urban	131(71.2%)	41(22.3%)	5(2.7%)	7(3.8%)	184
Total	207	65	11	17	300

The above table shows increased perinatal mortality i.e., 13.8% in babies of patients from rural residence when compared to urban population with 6.5% perinatal mortality.

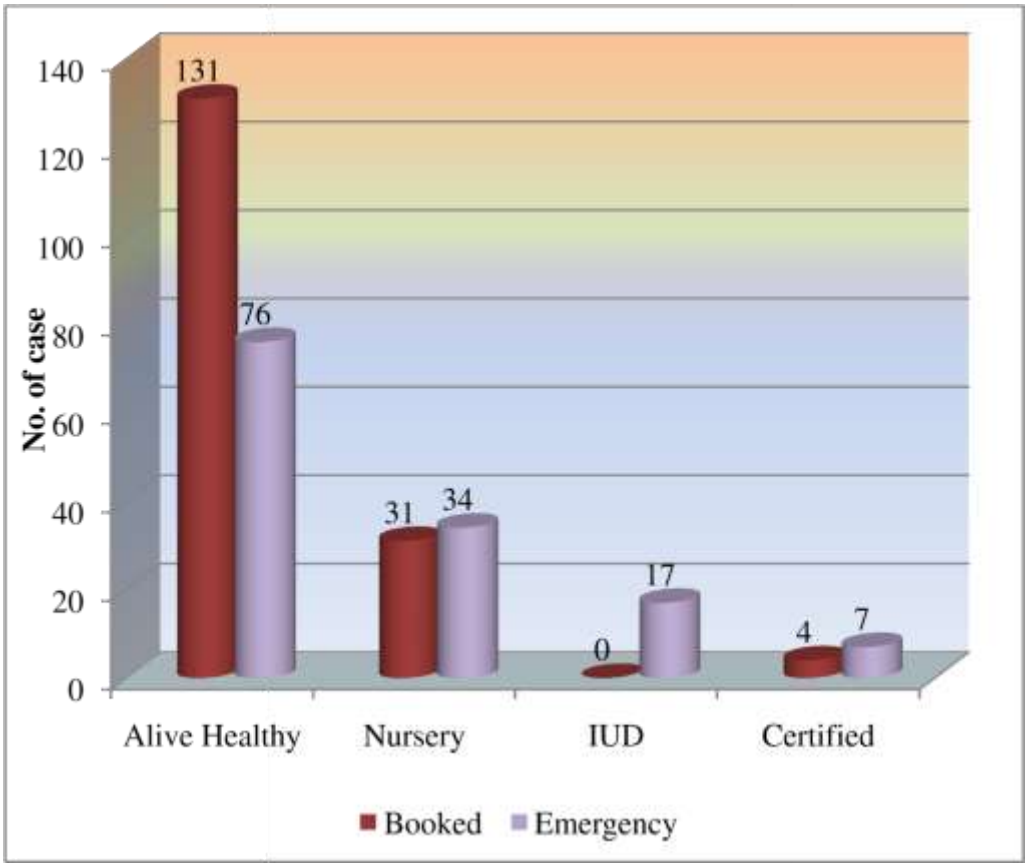


Graph 4:- Perinatal Outcome in relation to Residential status.

Table 5:- Perinatal Outcome in relation to Antenatal visits.

Status	Alive Healthy	Nursery	IUD	Certified	TOTAL
Booked	131(78.9%)	31(18.6%)	0	4(2.4%)	166
Emergency	76(56.7%)	34(25.3%)	17(12.6%)	7(5.2%)	134

The above table shows significantly increased perinatal mortality of 17.8% in patients with no prior antenatal visits when compared to booked cases with a perinatal mortality of 2.4%.



Graph 5:- Perinatal Outcome in relation to Antenatal visits.

Table 6:- Distribution of Study Patients as per Parity.

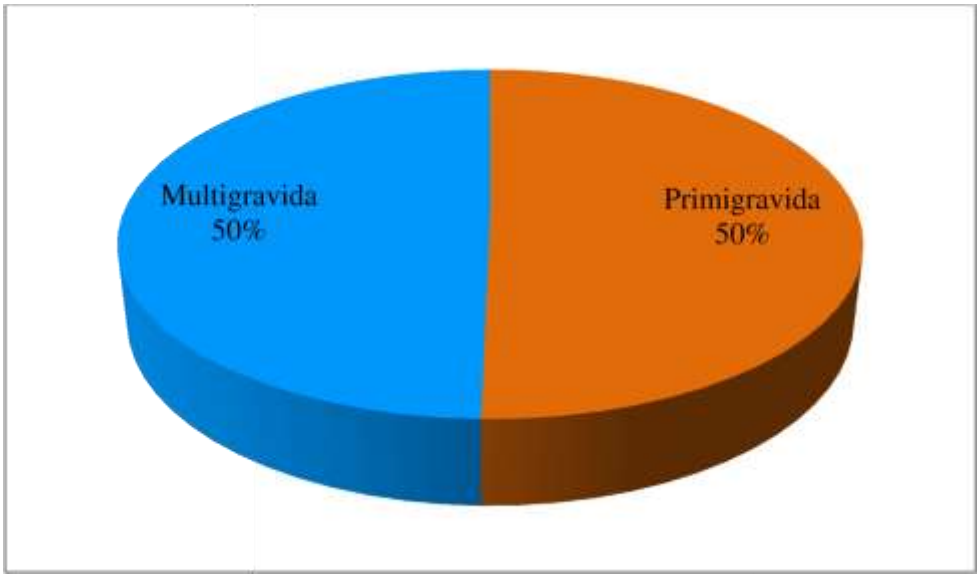
Parity	Number of Cases	Percentage
Primigravida	151	50.33%
Multigravida	149	49.67%
Total	300	100%

The table 6 shows that primigravida constitute 50.3% of the study population.

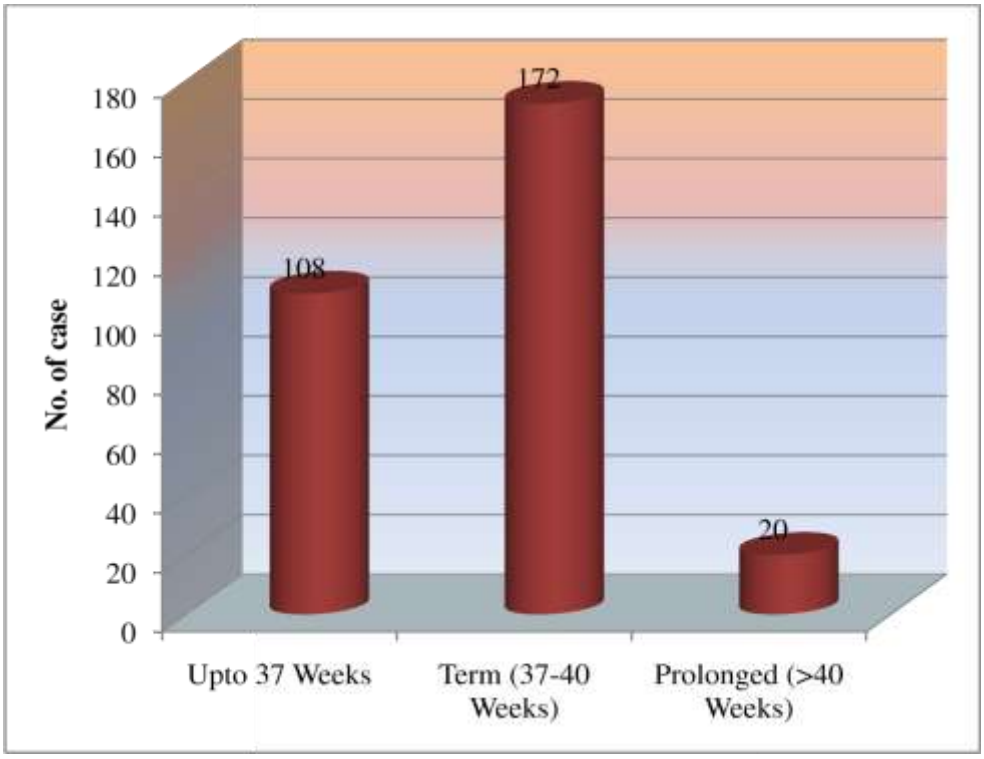
Table 7:- Distribution of Patients as per Gestational Age.

Gestational Age	Number of Cases	Percentage
Upto 37 Weeks	108	36%
Term(37-40 Weeks)	172	57.33%
Prolonged (>40 Weeks)	20	6.67%
Total	300	100%

The table shows that the Preterm constitutes 36% of study population and 57.3% were of term gestation, 6.6% were of prolong gestation with mean gestational age 37.24+2SD



Graph 6:- Distribution of Study Patients as per Parity.



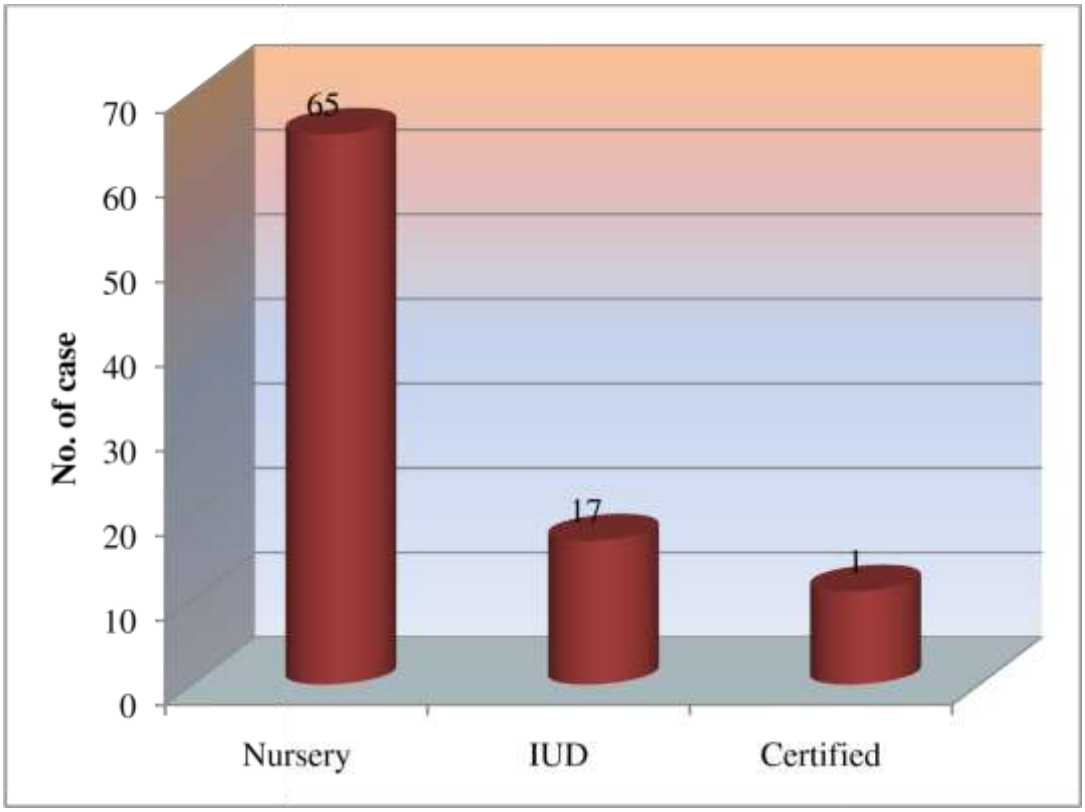
Graph No. 7:- Distribution of Patients as per Gestational Age.

Table 8:- Distribution of cases according to Perinatal Outcome.

Perinatal Outcome	Number of Cases	Percentage
Healthy	207	67.4%
Nursery	65	21.2%
IUD	17	5.5%

Certified	11	3.6%
Total	300	100%

Out 300 cases 67.4% babies were healthy, 21.2% had nursery admission, 3.6% has been certified, 5.5% were IUD. 9.1% Perinatal mortality



Graph 8:- Distribution of cases according to Perinatal Outcome.

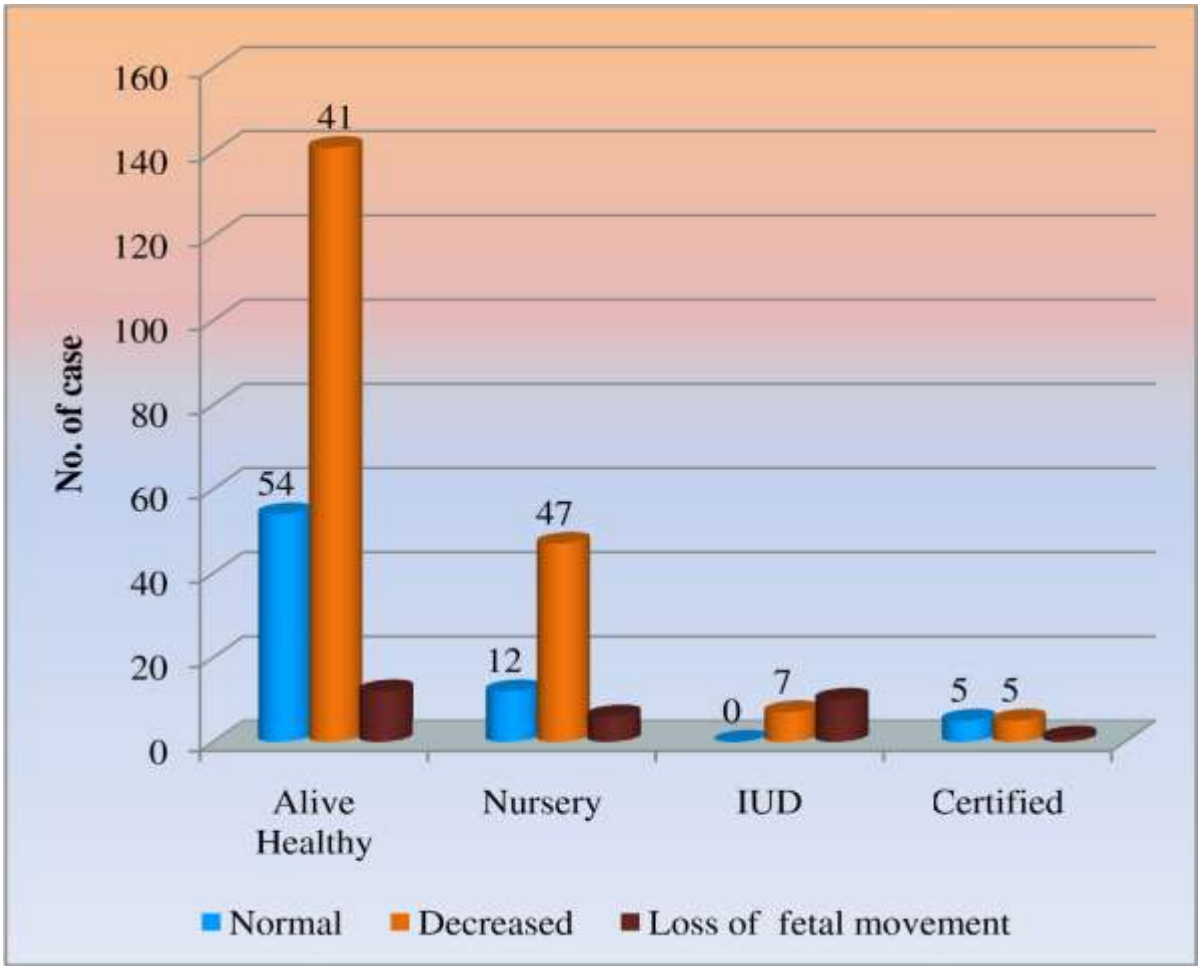
Table 9:- Distribution of Perinatal Outcome as per DFMC.

DFMC	Alive Healthy	Nursery	IUD	Certified	Total
Normal	54(76%)	12(16.9%)	0	5(7%)	71
Decreased	141 (70.5%)	47(23.5)	7(3.5%)	5(2.5%)	200
Loss of fetal movements	12(41.4%)	6(20.7%)	10(34.5%)	1(3.4)	29
Total	207	65	17	11	300
P-value 0.00 (<0.05 significant at 95% confidence intervals)					

The table shows DFMC has significant correlation with perinatal outcome.

In patients with loss of fetal movements only 41.4% were healthy, 6% were morbid babies n mortality was increased upto 37.9% out of which 34.5% were IUD.

Perinatal mortality significantly increased to 43.9% in patients with abnormal DFMC compared to that of 7% perinatal mortality in patients normal DFMC.



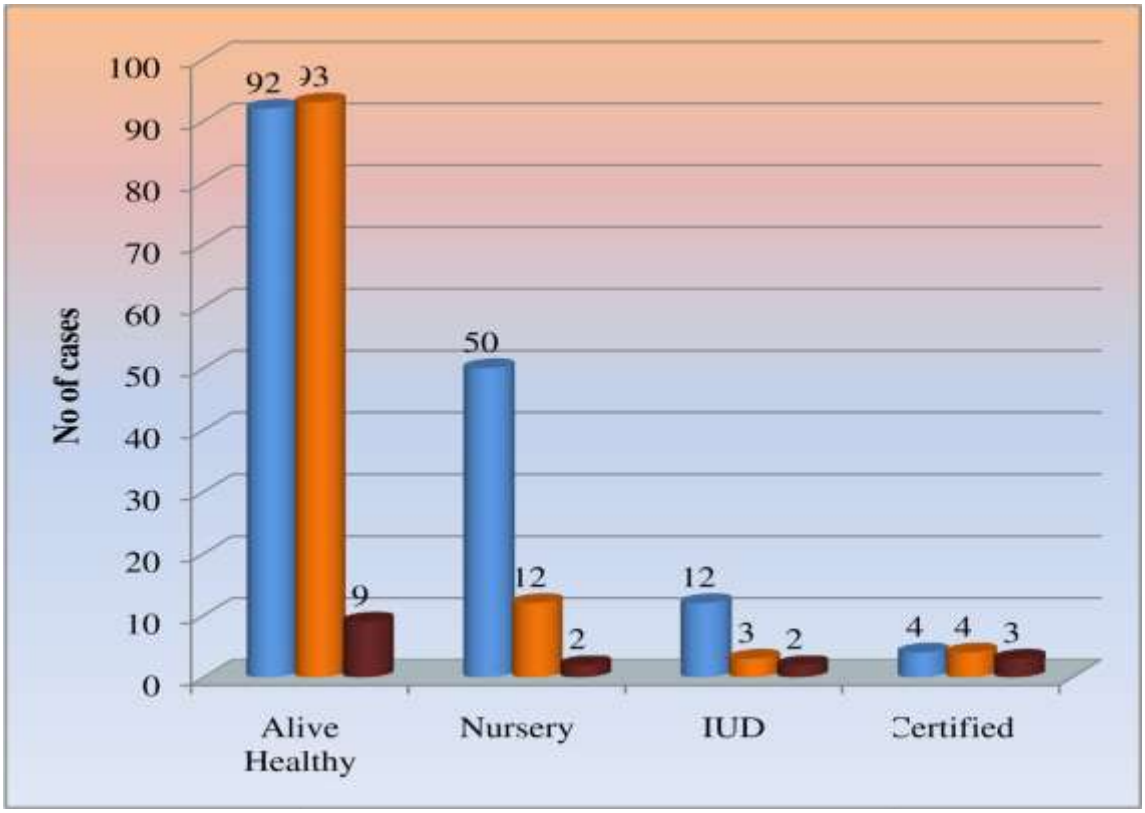
Graph 9:- Distribution of cases according to Perinatal Outcome as per DFMC.

Table 10:- AFI as a predictor of perinatal outcome.

AFI	Perinatal outcome				Total
	AH	NR	CERT	IUD	
Normal (5-24)	82 (93.2%)	03 (3.4%)	03 (3.4%)	0	88
Oligo(<5CM)	117 (59.1%)	60 (30.3%)	06 (3%)	15 (7.6%)	212
Poly(>24CM)	08 (57.1%)	02 (14.3%)	02 (14.3%)	02 (14.3%)	14
Total	207	65	11	17	300

Chi Square Test Applied, P-value 0.00 (<0.05 significant at 95% confidence intervals)

1. The table shows AFI abnormalities also have significant correlation with perinatal outcome.
2. In those with abnormal AFI only 55.3% babies were healthy, and perinatal morbidity and mortality significantly raised to 27.4% and 11.0% respectively.
3. In oligohydramnios 59.1% were healthy and increased perinatal morbidity of 30.3% and mortality of 10.6% were seen in comparision with polyhydramnios where only 57.1% were healthy, perinatal morbidity seen to be 14.3% and mortality of 14.3% seen.



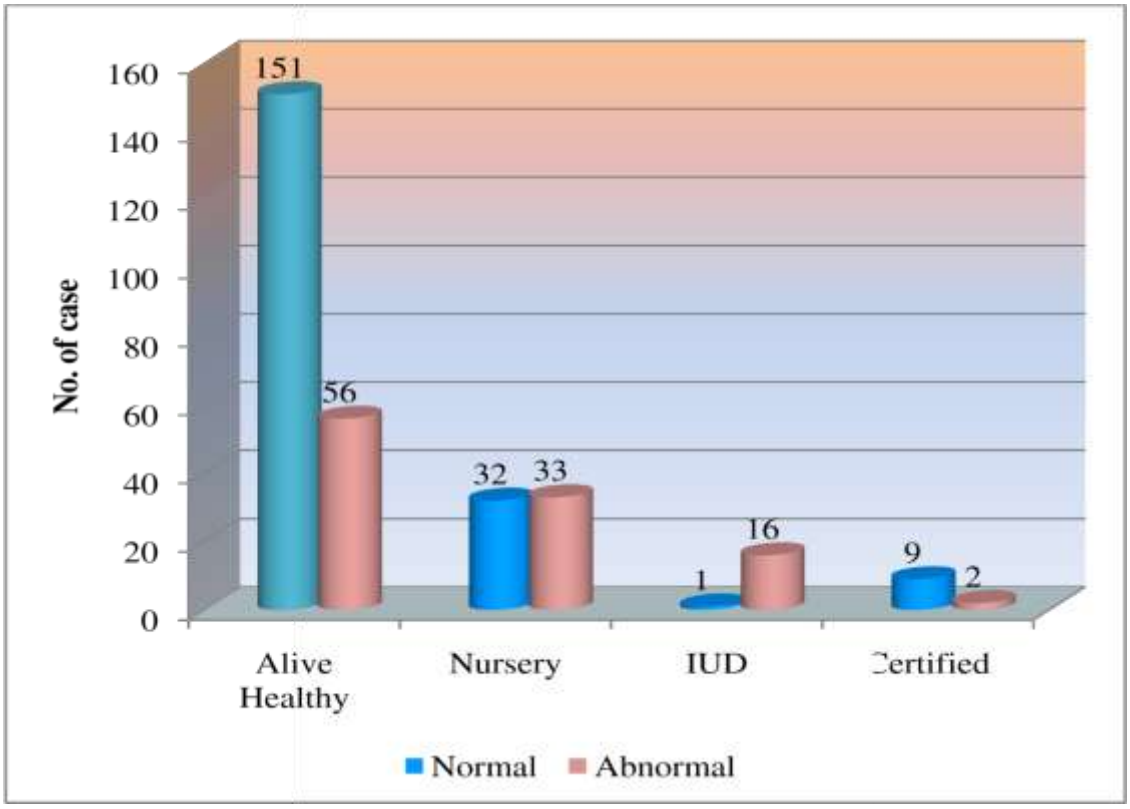
Graph 10:- AFI as a predictor of perinatal outcome.

Table 11:- Perinatal outcome as per Color Doppler.

Color Doppler	H	NR	CERT	IUD	TOTAL
NORMAL	153 (78.8%)	34 (17.5%)	7 (3.6%)	0	194
Early Fetal Hypoxia	40 (67.8%)	17 (28.8%)	1 (1.7%)	1 (1.7%)	59
Uteroplacental insufficiency	14 (48.3%)	10 (34.5%)	2 (6.9%)	4 (10.3%)	29
Absent / Reversal of end diastolic flow	0	4(80%)	1 (20%)	0	5
Total	207	65	11	04	287*

Chi square test applied P value 0.00 (significant at 95% confidence intervals)

1. Color Doppler also has significant correlation with perinatal outcome.
2. Significantly increased morbidity and mortality of 34.5% and 17.2% is associated with umbilical artery flow changes when compared to middle cerebral artery flow changes with 3.4% perinatal mortality.
3. As per the table fetus with AEDF/REDF 80% were morbid and 20% undergone perinatal mortality.



Graph 11:- Perinatal outcome as per Color Doppler.

Table 12:- Sensitivity of Various Indices with Perinatal Outcome.

DFMC & CD

DFMC	Color Doppler		Total
	Abnormal	Normal	
Abnormal	87(91.5%)	131(68.2%)	218
Normal	08(8.4%)	61(31.7%)	69
Total	95	192	287

Chi Square Test Applied, P value --0.00 (<0.05 significant at 95% confidence intervals) (excluding 13 IUD)

1. With Color Doppler as gold standard, DFMC has sensitivity of 91.5% which is very high for aindice to be used as a screening tool and specificity of 31.7%
2. DFMC has also seen to have high rate 68.2% as false positive cases.

b) AFI & CD

AFI	Color Doppler		Total
	Abnormal	Normal	
Abnormal	71(74.7%)	129(67.1%)	200
Normal	24(25.3%)	63(32.8%)	87
Total	95	192	287

Chi Square Test Applied, P-Value 0.036((<0.05 significant at 95% confidence intervals) (excluding 13 IUD with no color Doppler)

1. With color Doppler as gold standard, AFI cases 74.7% sensitivity and specificity of 32.8% as per our study.
2. It has detected 67.1% as falsely positive cases.

c)DFMC & AFI

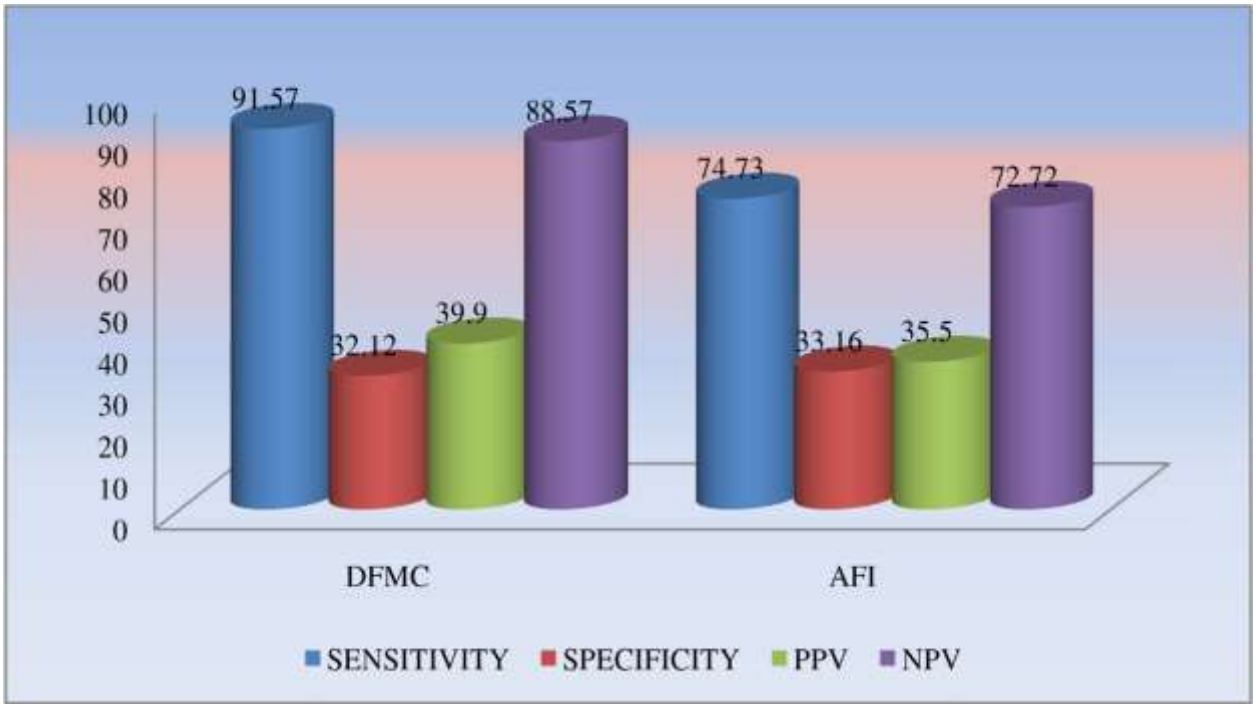
DFMC	Amniotic Fluid Index		Total
	Abnormal	Normal	
Abnormal	149 (79.7%)	60 (68.2%)	229
Normal	43 (20.3%)	28 (31.8%)	71
Total	192	88	300

The table shows that DFMC is predictive of AFI abnormalities in 79.7% of cases but it also predicts false positive cases in as many as 68.2% of cases.

Comparison of 2 indices with color Doppler as standard.

Indices	Sensitivity	Specificity	PPV	NPV
DFMC	91.57	32.12	39.90	88.57
AFI	74.73	33.16	35.5	72.72

From the table DFMC seen to have highest sensitivity of 91.57% to detect the diseased cases.



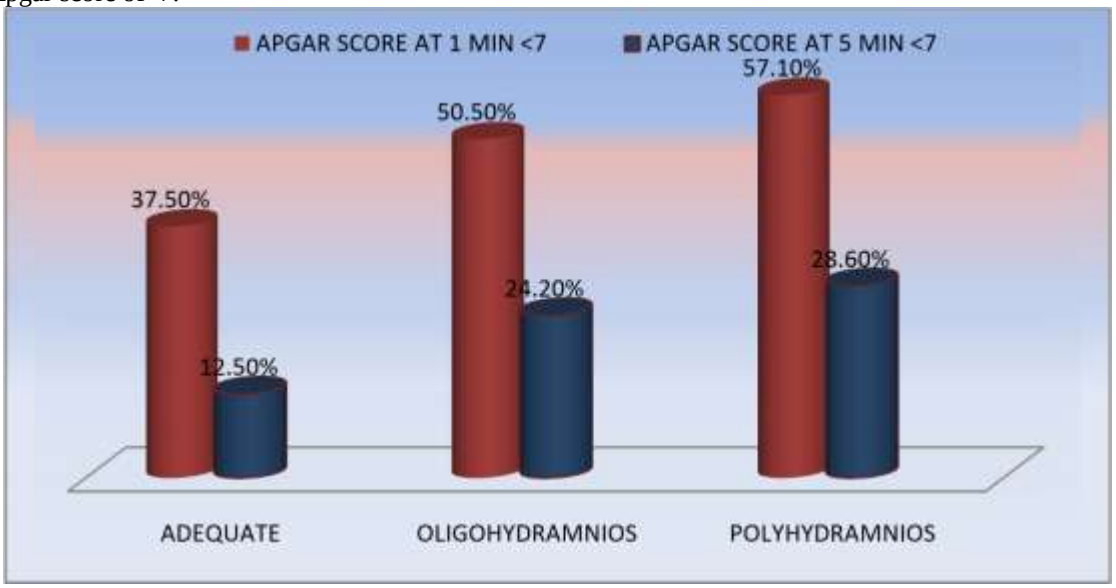
Graph 12:- Comparison of DFMC & AFI indices with color Doppler as standard.

Table 13:- AFI abnormalities and APGAR SCORE of newborns at 1 min and 5 min.

AFI		Apgar Score At 1 min		Apgar Score At 5 Min	
		< 7	>7	<7	>7
Adequate		33 37.5%	55 62.5%	11 (12.5%)	77 (87.5%)

Oligohydramnios		100 50.5%	98 49.5%	48 (24.2%)	150 (75.8%)
Polyhydramnios		8 57.1%)	6 (42.9%)	4 (28.6%)	10 (71.4%)
Total		141	159	63	237

At the end of 5 min the score has improved and 24.2% of oligohydramnios and 28.6% of ployhydramnios seen to have Apgar score of<7.



Graph 13:- AFI abnormalities and APGAR SCORE of newborns at 1 min and 5 min.

Table 14:- Specificity and Sensitivity of Various Indices for Detection of SGA Fetus.
a)Color Doppler

Color Doppler	SGA	AGA	TOTAL
Abnormal	43(47.7%) (35.2%)	47(52.2%) (29.1%)	90
MCA	25	34	59(65.5%)
UA	18	13	31(34.4%)
Normal	79 (40.9%) (64.7%)	114(59%) (70.8%)	193
Total	122	161	283
Chi Square Test Applied P value 0.00 (significant at 95% confidence intervals)			

Excluding 17 IUD with no color Doppler.
Above table shows that Color Doppler has 35.2% sensitivity (true positive cases) and specificity of 70.8%. Thuscolor is more specific predictor for SGA fetus.

The incidence of abnormal Doppler flow is 31.8% which has constituted for 47.7% SGA fetuses i.e., abnormal Doppler flow predicted almost half of SGA fetus.

b) AFI

AFI	SGA	AGA	TOTAL
Abnormal	95(48.9%)	99(51%)	194
Normal	27(30.6%)	61(69.3%)	88

Total	122	160	282

P value 0.00 (significant) excluding 1 LGA and 17 IUD

The table shows significant association of AFI with increased incidence of SGA fetus. 48.9% of SGA fetus were seen to be associated with abnormal AFI and so it has sensitivity of 48.9% with a specificity of 69.3%.

c) DFMC

DFMC	SGA	AGA	Total
Abnormal	93(69.4%)	119(80%)	212
Normal	41(30.5%)	29(20%)	70
Total	134	148	282

P Value 0.00 which is significant (p value <0.05 at 95% confidence intervals) (excluding 1 LGA and 17 IUD)

DFMC as a predictor seen have 69.4% sensitivity with only 20% specificity.

It suspects 80% of AGA fetus as false positive cases thereby over diagnosing the condition and leading to premature delivery of fetus.

Comparison of DFMC, AFI &color Doppler as standard

Indices	Sensitivity	Specificity	PPV	NPV
Color Doppler	35.77	71.06	48.88	40.07
AFI	77.86	38.12	48.96	69.31
DFMC	69.40	19.59	43.86	41.42

DFMC seen to have 69.4% sensitivity with very low specificity of 19.5%. AFI has the highest sensitivity of 77.8% and color Doppler has highest specificity of 71% in detection of SGA fetus.

Table 15:- AFI Abnormalities in prediction OF SGA fetus.

AFI	AGA	SGA	LGA	Total
Normal	61(69.3%)	27(30.7%)	0	88
Oligo	91(49.7%)	92(50.2%)	0	183
Poly	8(66.6%)	3(25%)	1(8.3%)	12
Total	160	122	1	283*

Chi Square Test Applied P-value-0.00 (p value<0.05 significant at 95% confident intervals) (* excluding 17 IUD)

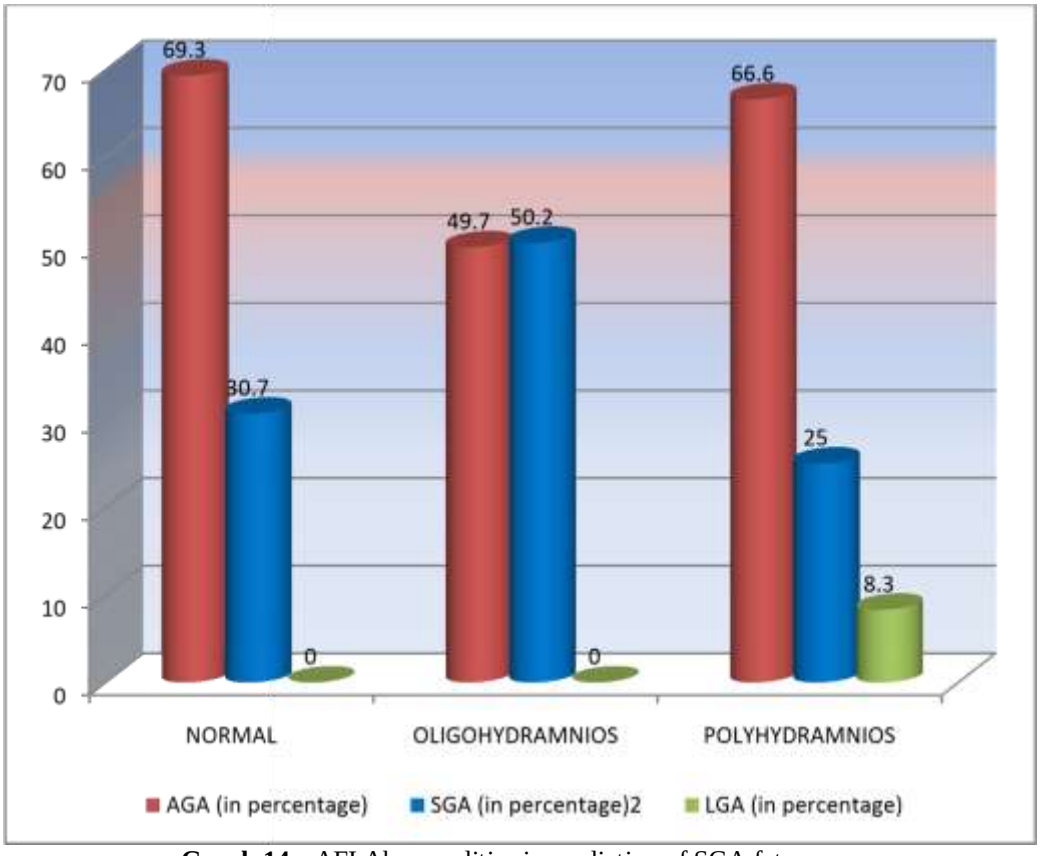
The above table shows significant correlation of SGA fetus with oligohydramnios which are associated with 50.2% of SGA fetus.

Table 16:- Association of oligohydramnios with congenital anomalies.

Name of Congenital anomaly	No. of cases	Percentage
Urinary tract system	11	3.6%
• Hydronephrosis /hydroureter	5	1.6%
• Renal agenesis	2	0.66
• Renal ectasia	2	0.66

• Polycystic kidney disease	2	0.66
• Posterior urethral valve	0	0
Potter syndrome	1	0.33
CTEV	2	0.66
Cleft Palate	1	0.33
Amniotic band syndrome	1	0.33
Pulmonary hypoplasia	1	0.33
Hydrocephalus	1	0.33
Gastrointestinal system (Duodenal Atresia &Tracheo-esophageal fistula)	2	0.66
Cardiac anomaly	0	0
Others	0	0

In our study, incidence of congenital anamolies associated with antenatal patients oligohydramnios and polyhydramnios is 6.6%. Most of anamolies i.e., 3.6% were related urinary tract system.



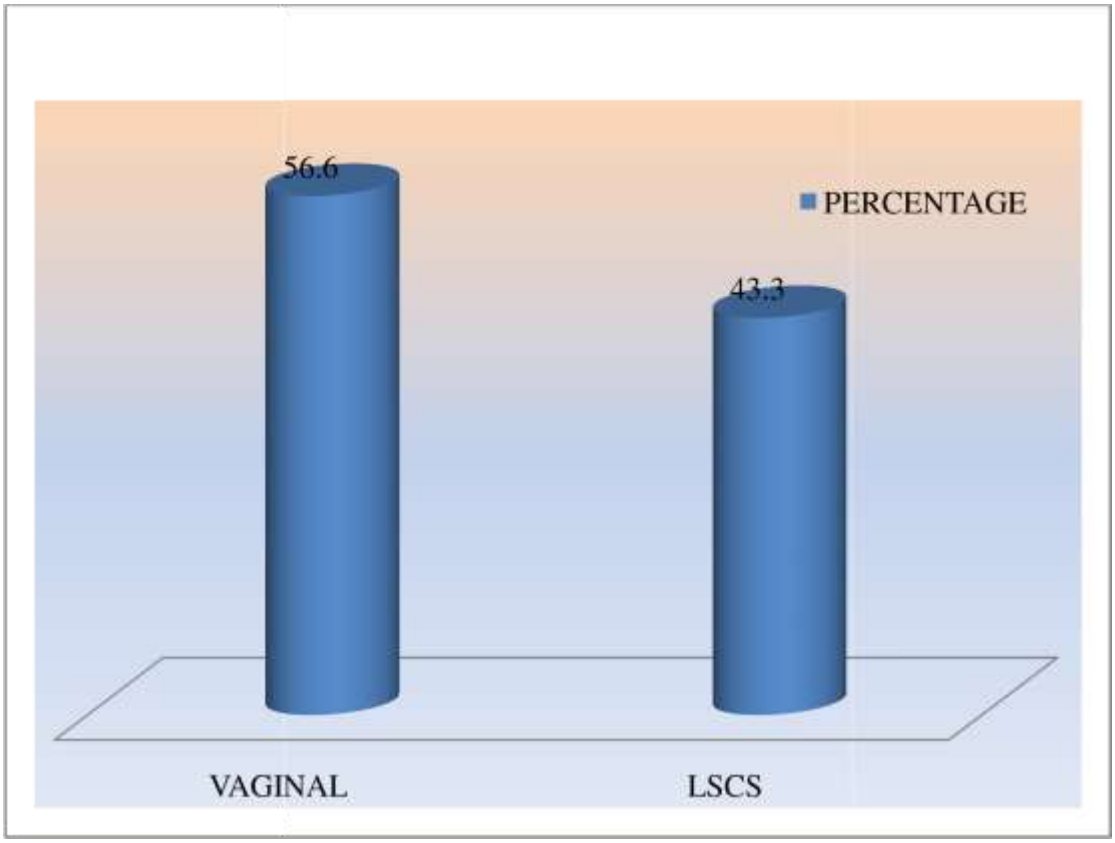
Graph 14:- AFI Abnormalities in prediction of SGA fetus.

Table 17:- Distribution of Patient as per Mode of Delivery.

Mode of Delivery	**Number**	**Percentage**
Vaginal	**170**	**56.6%**

LSCS	130	43.3%
Total	300	100%

Out of the total study cases 56.6% delivered vaginally and 43.3% undergone LSCS for various indications. Out of which 23% LSCS were because of previous sections.



Graph 15:- Distribution of Patients as per Mode of Delivery.

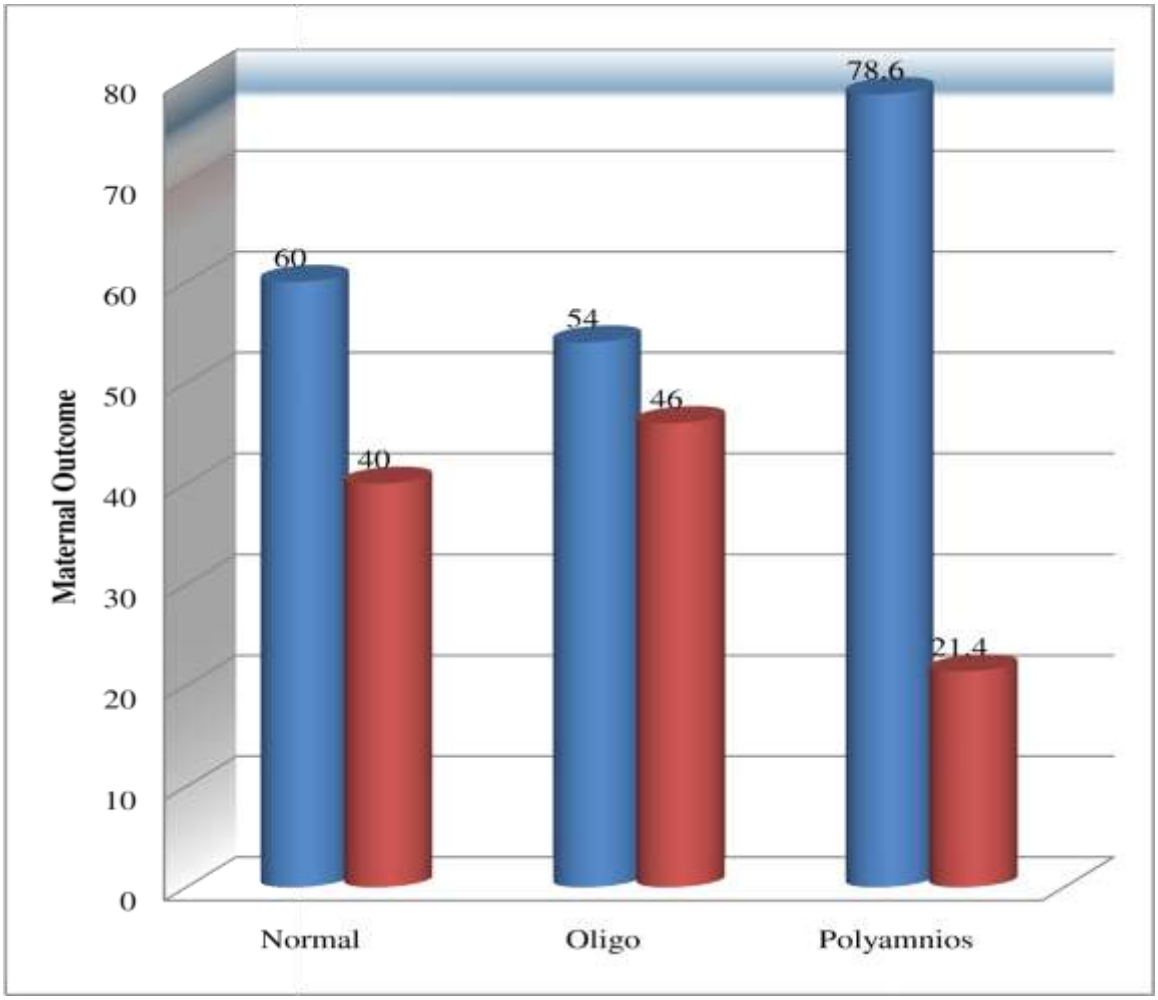
Table 18:- AFI Abnormalities and Maternal Outcome.

AFI	**Maternal Outcome**		**Total**
	Vaginal	**LSCS**	
Adequate	52 (60%)	36 (40%)	88
Oligohydramnios	107 (54%)	91 (46%)	198
Polyhydramnios	11 (78.6%)	3 (21.4%)	14
Total	170	130	300

P-Value 0.181 (Insignificant at 95% confidence intervals)

The table states that there is no significant relationship between the

AFI and the mode of delivery.
In our study incidence of LSCS in oligohydramnios seen to be 46% and 54% have undergone vaginal delivery.

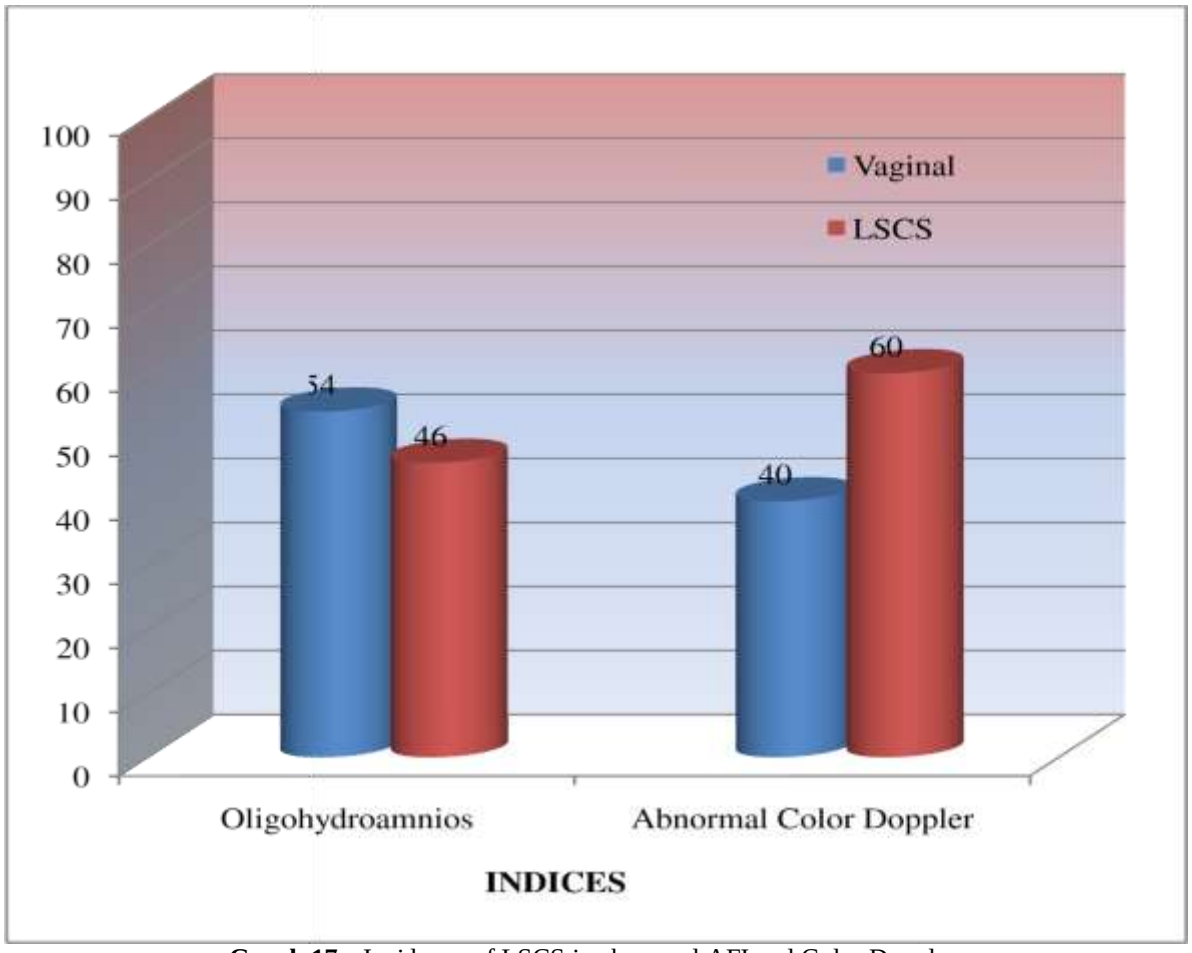


Graph 16:- AFI Abnormalities And Maternal Outcome.

Table 19:- Incidence of LSCS in abnormal AFI and Color Doppler.

Indices	Vaginal	LSCS	Total
Oligohydramnios	107(54%)	91(46%)	198
Polyhydamnios	11 (78.6%)	3 (21.4%)	14
Abnormal Color Doppler	38 (40%)	57(60%)	95
MCA	25(41.6%)	35(58.3%)	60
UA	13(37.1%)	22(62.8%)	35

In our study, incidence of LSCS in oligohydramnios is seen to be 46% and incidence as high as 60% seen in those with abnormal color Doppler flow changes.



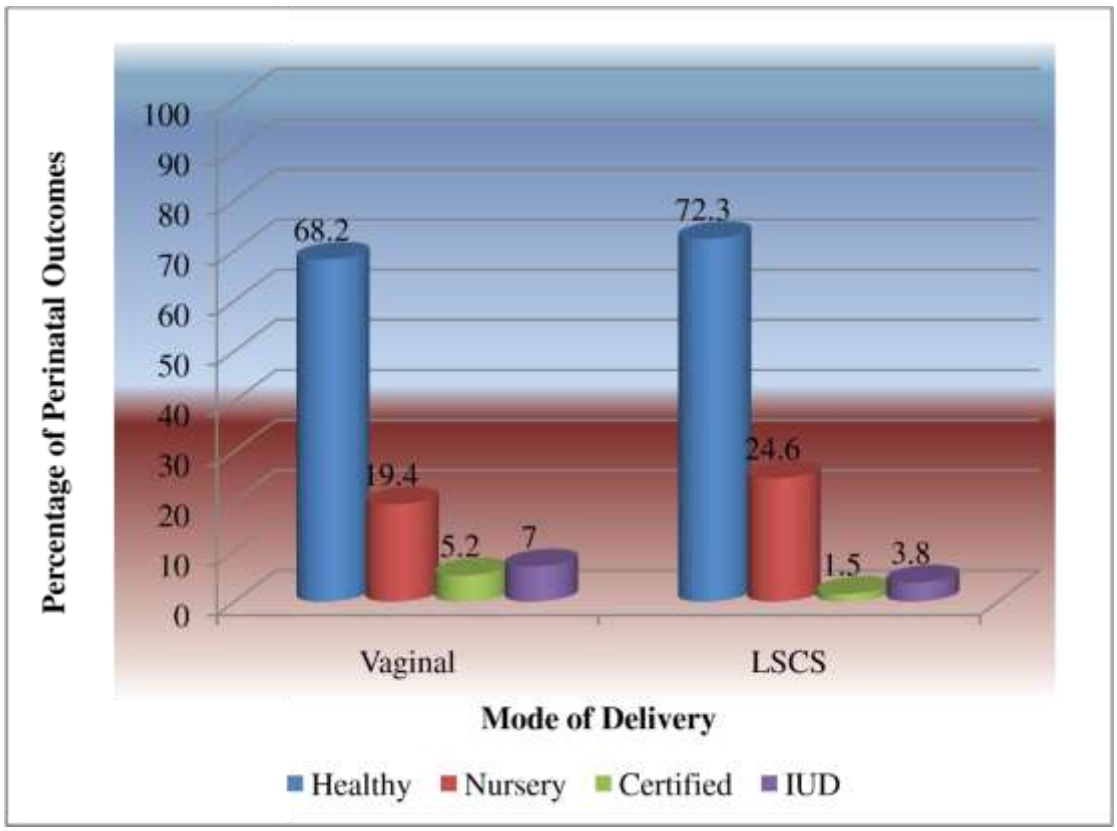
Graph 17:- Incidence of LSCS in abnormal AFI and Color Doppler.

Table 20:- Mode of Delivery and Perinatal Outcome.

Mode of delivery	Healthy	Nursery	Certified	IUD	Total
Vaginal	116(68.2%)	33(19.4%)	09(5.2%)	12(7%)	170
LSCS	91(72.3%)	32(24.6%)	02(1.5%)	05(3.8%)	130
Total	207	65	11	17	300

P Value 0.16 (insignificant at 95% confidence intervals)

There is insignificant difference in proportion of healthy babies of 72.3% in LSCS when compared to 68.2% fetus in vaginal deliveries, but there is significant reduction 5.3% in perinatal mortality in those delivered by LSCS when compared to 12.4% in vaginal deliveries.

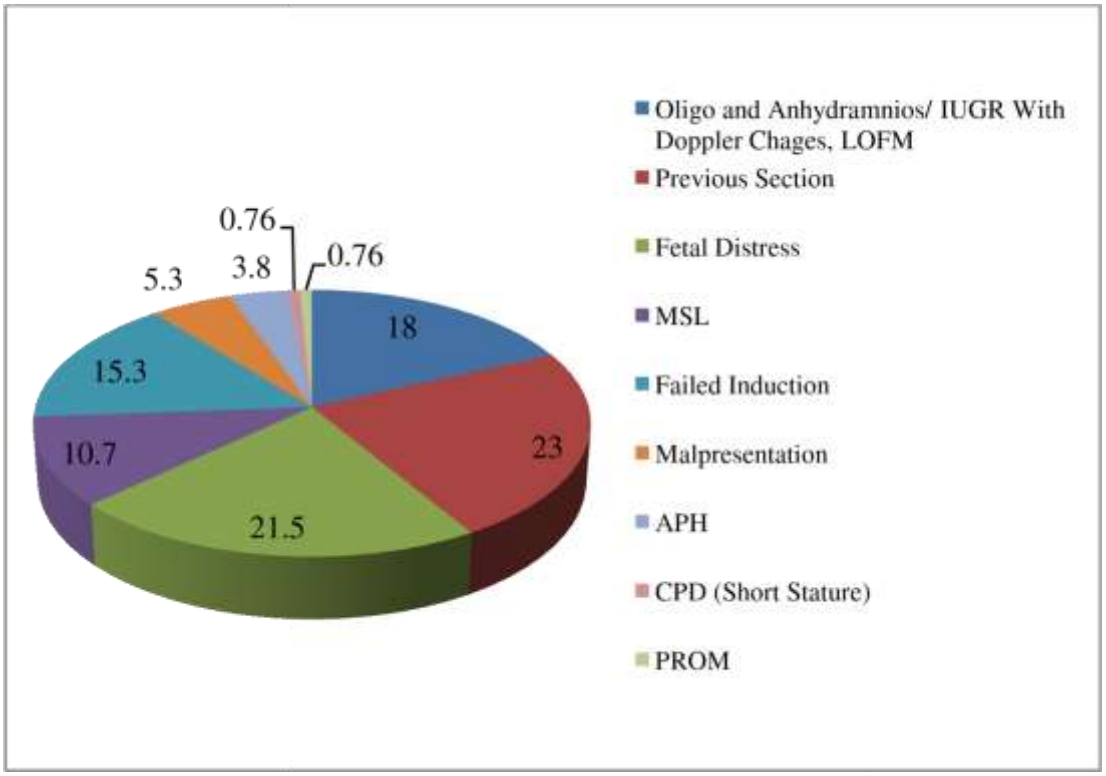


Graph 18:- Mode of Delivery and Perinatal Outcome.

Table 21:- LSCS and Indications.

Indications	Number	Percentage
Total LSCS	130	43.3%
Oligo and anhydramnios/ IUGR with Doppler Changes, LOFM	24	18%
Previous Section	30	23%
Fetal distress	28	21.5%
MSL	14	10.7%
Failed Induction	20	15.3%
Malpresentation	07	5.3%
APH	05	3.8%
CPD(Short Stature)	01	0.76
PROM	01	0.76

The common indications which lead to LSCS (excluding previous section which is 23%) seen to be Fetal Distress in 21.5% cases followed by Oligo IUGR With Doppler Changes in 18% cases. 15.3% cases have undergone LSCS for failed induction and 10.7% cases for MSL.



Graph 19:- Distribution of LSCS and Indications.

Table 22:- High Risk Factors and Perinatal Outcome.

High Risk	**Number**	**Percentage**
GHTN	33	11%
Preclampsia	30	10%
Eclampsia	5	5%
Prolonged pregnancy	20	6.6%
Breech	15	5%
PROM	16	5.3%
Placenta Previa	6	2%
Rh Negative maternal high risk factor associated with oligohydramnios is Hypertensive disorders of pregnancy, seen in 68(22.6%) cases.	5	1.6%
Hypothyroidism	5	1.6%
Chorioamniotis	1	0.3%

The most common maternal high risk factor associated with oligohydramnios is Hypertensive disorders of pregnancy, seen in 68(22.6%) cases.

Discussion:-

The present study is to study the relationship of DFMC, AFI and COLOR DOPPLER with perinatal outcome, was conducted at Maharaja Yashwantrao Hospital, MGM Medical College, Indore, a tertiary care centre of central India, department of Obstetrics &Gynecology, from April 2015 to March 2016.

The following are the various aspects of the study:

Age:

In this study majority of patients belong to age group of 20-30 years with Mean age group of study cases 24.94+2SD which is comparable with that of study conducted by Conway et al [6] and Brian M. Casey et al [7].

Author / Name of the study	Study group vs control
Conway et al Brian M. Casey et al Chauhan P et. al. Everett F et. al.	24.4 ± 0.4 vs 23.0 ± 0.4 23.9 ± 5.9 vs 24.6 ± 6.1 23.6 ± 6.5 years, 23.8 ± 5.7 years
Our Study	24.9+ 2SD

1) In the study rural population constitutes 38.6% and so about 1/3 of patients i.e., 32.6% of cases were illiterate. Also there is increased perinatal mortality of 13.8% in patients from rural residence when compared to urban population with 6.5% perinatal mortality. This shows the indirect impact of residency and illiteracy on perinatal outcome and the need for urbanization and outstretching of health services in rural areas in a developing country like India where the most of population resides countryside. WHO says Three-forths of the stillbirths occured in south Asia and sub-Saharan Africa and 60% occurred in rural families from these areas.
2) Our study shows significantly increased perinatal mortality of 17.8% in patients with no prior antenatal visits in comparision to booked cases with perinatal mortality of 2.4%. This data shows that a significant proportion of perinatal mortality can be reduced with health education i.e., preconceptional, antenatal counseling and regular antenatal care of pregnant females. Primigravida constituted 50.3% of the study population with rest of 49.7% of multigravida compared to the study of Haifa A. Alchalabi et al with 54.5% primigravida and 45.5% multigravida. Preterm constitutes 36% of study population and 57.3% were of term gestation, 6.6% were of prolong gestation with mean gestational age 37.24+ 2.4.

Author / Name of the study (yrs	M ean Gestational Age
Jun Zhang James et al HinaAhna, Shama et al	38.1 ± 3.3
Casey B et al.	37.8 ± 1.3 37.5 ± 2
Suchitra et al	38.4 ± 0.6
Our study	37+ 2.4

This study included antenatal cases with gestational age more than 28 weeks and those with high risk factors with mean gestational age 37+ 2.4 weeks. Jun Zhang et. al.[8], Casey B et al, and Iffath A et. al.[9] found that, the mean gestational age were 38.1 ± 3.3 weeks, 37.5 ± 2 weeks, and 36.3±2 which were nearly equal to that of our study. These findings indicate that the problem of oligohydramnios was more common in the later part of pregnancy. It is mainly due to physiological or pathological causes of reduced placental perfusion near term.

3) Out 300 cases 67.4% babies were healthy, 21.2% had nursery admission, 3.6% has been certified, 5.5% were still born i.e., 9.1% perinatal mortality has been seen in our study.

DFMC:

All the three seen to have significant correlation with perinatal outcome. Patients with decreased DFMC found 70% healthy with perinatal mortality of 6% in comparision to the analysis done by the Confidential Enquiry into Stillbirths and Deaths in Infancy (CESDI) (95)under the umbrella of the National Institute for Clinical Excellence (NICE) collected and analysed data of deaths between 20 weeks gestation and one year of life found 16.4% perinatal death in those with altered or decreased fetal movements.

In those with loss of fetal movements only 41.3% were healthy, and mortality was increased upto 44.7% out of which 34.5% were still born. As per (Efkarpidis, Alexopoulos, Kean, Liu, & Fay, 2004[10]half of still birth cases the woman reports a history of decreased fetal movements prior to diagnosis.). Warrander&Heazell, 2011[11] hypothesised that decreased fetal movements might be a compensatory measure to reduce energy expenditure in the

context of placental insufficiency. Thus the relationship between IUGR, stillbirth and decreased fetal movements is well documented (Warrander&Heazell, 2011; Winje, Roald, Kristensen, &Frøen, 2012[12]

Amniotic Fluid Index:
In those with abnormal AFI only 59% babies were healthy, and perinatal morbidity and mortality significantly raised to 29.2% and 11.8% respectively. in those with oligohydramnios seen to have perinatal mortality of 10.6% which is nearly comparable with 9.9% mortality rate in a study conducted by Apel-Sarid L et al. [13]. Casy et al. reported 6.4% perinatal death

In those with polyhydramnios only 57.1% were healthy, mortality of 14.3% seen which is relatively high might be due to congenital anamolies. A comparison of 4001 patients with normal amniotic fluid to 210 with polyhydramnios found that polyhydramnios was an independent risk factor for perinatal mortality (OR, 5.8; 95% CI, 3.68–9.11)[14]. This association also held true in a large retrospective study of over 200,000 singleton births in which logistic regression confirmed polyhydramnios is independently associated with stillbirth (OR, 1.8; 95% CI, 1.4–2.2; P<0.001)[15]. As with isolated oligohydramnios, isolated polyhydramnios has been reported to have a lower perinatal mortality than cases with additional fetal abnormalities [16].

Reduce amniotic fluid carries an increased risk of an intrapartum complication in high-risk pregnancies[17,18]. Casey et al found perinatal mortality 9.9% in oligohydramnios which is nearer 10.6% to that of our study. Manning and Platt[19] well established relationship between sonography detected Oligohydramnious and perinatal morbidity, and mortality. Chhabra S et. al.[20] reported very high (87.7%) perinatal mortality in their study. Wolff F et al. found that the perinatal mortality in their study was 7.2%. Apel-Sarid L et al. found that the perinatal mortality was 9.9%. Chamberlin PF et al.[21] calculated the gross and corrected perinatal mortality rate in patients with decreased qualitativeamniotic fluid volume and found it to be 188/1000 and 109/1000 respectively .

Color Doppler:
Patients with normal color Doppler had 78.8% healthy babies, perinatal morbidity 17.5% and perinatal mortality of 3.6% In those with abnormal color Doppler only 58% were healthy, 33.3% of perinatal morbidity and 8.6% mortality (4.3% still born and 4.3% certified). Trudinger et aldemonstrated poor fetal outcome in 63%. Among the babies with MCA flow changes 67.8% were healthy, and 3.4 % undergone perinatal mortality. In the pts with Umbilical artery flow changes only 48.3% were healthy and it was significantly associated with increased perinatal mortality i.e., 17.2% (10.3% still born and 6.9% certified).Yoon et al[22] demonstrated in their study absent umbilical artery wave form is a strong and important predictor of adverse perinatal outcome. AEDF/REDF changes predicted 80% were morbid and 20% undergone perinatal mortality. Perinatal death has been observed to occur in >20% of pregnancies with absent or reversed end-diastolic flow in the umbilical artery.[23,24] Middle cerebral artery Doppler can detect brain sparing in IUGR, which has been associated with neurobehavioral impairment in survivors[25]. As an individual test of fetal well-being, Doppler velocimetry has been most widely studied in the setting of IUGR. In a recent Cochrane review of 18 studies of >10,000 high-risk pregnancies, the use of Doppler US was associated with a reduction of perinatal death (risk ratio [RR], 0.71; 95% CI, 0.52–0.98). There were also fewer inductions of labor and cesarean deliveries.

AFI Abnormalities and Perinatal Outcome:
As per our study 24.2% of oligohydramnios and 28.6% of ployhydramnios seen to have Apgar score of <7 which is clinically significant. Casey et al reported an NICU admission rate of 7% in patients with oligohydramnios. Locatelli A et. al.[26] of 341 patients with oligohydramnios, found no significant difference for Apgar score of less than 7 at 5 minute in study and control group. In Manning et al[27] 15% babies had APGAR score < 7. In Raj Sariya et al, it was 38%. In Julie M Jhonson et al[28] 20% babies had NICU admission. In Manning et al[29] and Raj Sariya et al[30], 43% and 88.88% respectively.

Incidence of SGA fetus in our study seen to be 43.6% comparable with Philipson EH et al[31] 60% AGA and 40% SGA and In Manning et al with64% AGA and 36% SGA fetuses. This high percentage of SGA babies suggesting correlation of IUGR with Oligo-hydramnios. DFMC seen to have the high sensitivity of 69.4%. As per the study done by O'Sullivan et al., 2009; Tveit et al., 2009 women who present with decreased fetal movements also have a higher incidence of fetal growth restriction and preterm birth but a high rate of false positive cases thereby over diagnosing the condition and may lead to iatrogenic prematurity if it is relied upon alone.AFI with 48.9% sensitivity and 69.3% specificity has correlation with detection of SGA fetus but as the color Doppler has high specificity Of

71%, it is once again proved as gold standard in the diagnosis of SGA(32) and there by IUGR fetus. Those with abnormal color Doppler resulted in 47.7% SGA fetus. Hence Ultrasound assessment of amniotic fluid volume should not be used as the only form of surveillance in SGA fetuses.[33]

Mode of Delivery:
Coming to mode of delivery, oligo cases 54% delivered vaginally and 46% undergone LSCS for various indications comparable with caesarean section rate of 44% and vaginal delivery of 56% in a study of oligohydramnios conducted by)[34] and by Casey and co workers 8 (42%). In those with abnormal Doppler flow changes incidence of LSCS seen to be as high as 60%. The significantly higher operative morbidity of 60% in patients with altered Doppler study is comparable to this study done by Weiss et al[35] and Yound HK et al[36], where it was 71% and 69.7% respectively.

The increased rate of operative delivery in our study could be because the diagnosis of fetal distress was made depending on the fetal heart rate auscultation alone. Fetal acidosis was not proved by fetal scalp blood sampling or other methods due to non availability. On correlation with perinatal outcome Oligo with LSCS had 72.3% healthy babies with decreased perinatal mortality rate of 5.4% in comparision to 68.2% fetus healthy in vaginal deliveries with increased 12.4% perinatal mortality. Perinatal morbidity seen to be more in LSCS 24.6% compared to that of 19.4% of vaginal deliveries. This might be due to TTNB. The common indications which lead to LSCS (excluding previous section which is 23%) seen to be Fetal Distress in 21.5% cases followed by Oligo IUGR with Doppler changes in 18% cases. 15.3% cases have undergone LSCS for failed induction and 10.7% cases for MSL. Chauhan et al. [37] also concluded that AFI < 5cm is associated with increased risk of Caesarean section for fetal distress and low Apgar Score at 5 minute.

Congenital Anamolies:
Congenital anomalies associated with antenatal patients oligohydramnios and polyhydramnios. Most of anamolies i.e., 3.81% were of urinary tract system.

STUDY	INCIDENCE OF CONGENITAL ANOMALIES
Present Study	6.6%
Shetty et al (2013)	5.8%
Guin et al(2011)	8.5%
Golan (1994)	11%
Shenker et al(1991)	13.75%
Mercer and Brown(1986)	26%

In present study 6.6% cases were associated with congenital anomalies nearly equal to study done by Shetty A, Shetty S and Raicongenital malformations were detected in (5.8%) out of 120 cases with oligohydramnios. The most common congenital malformation was hydronephrosis. Four neonatal deaths were recorded in the study (3.3%). Golan (1994)[38] reported incidence of congenital anomalies to be 11% and that of lethal malformations 4.8% in cases of oligohydramnios. Genitourinary anomalies accounts for majority of congenital anomalies associated with oligohydramnios. In our study 14 cases were of genitourinary system, 2 of skeletal system, 1 of CNS, 1 potter syndrome.

Associated high risk factors
The most common maternal high risk factor associated with oligohydramnios is Hypertensive disorders of pregnancy, seen in 68(22.6%)cases of, out of which 33(11%) cases were of gestational hypertension, 30(10%)were of preeclampsia, 5(1.6%) cases were of eclampsia, 20(6.6%) cases of prolonged pregnancy, 16(5.3%)cases were of PROM, 15(5%)cases were of breech presentation, 6(2%)cases of placenta previa, 5(1.6%) cases of hypothyroidism and Rh negative, 1(0.3%) case of chorioamnionitis.

Most common cause of oligohydramnios seen is idiopathic followed hypertensive disorders of pregnancy being the most common associated risk factor. Golan A et al. in his study, found maternal hypertension in 22.1% cases. Mercer L J et al.[39] found that preeclampsia was present in 24.7% of cases with decreased fluid. Study by Chauhan P et. al. reported, preeclampsia in 12% cases.

Comparision of different studies as per hypertensive disorders, fetal distress, color of meconium and percentage of LSCS.

STUDY	Hypertensive Disorders	Fetal Distress	Percentage of LSCS
Chandra P et al (2000)	38.46%		76.92%
Sriya R et al [267] (2001)	31%	36.11%	43.05%
Guin et al [253] (2011)	3.5%	80%	42.8%
Present Study (2014)		21.5%	46%

Conclusion:-

In our study, all the three indices when abnormal were significantly associated with poor perinatal outcome. DFMC seen to be highly sensitive with more than half of the still births reporting with chief complaint of loss of fetal movements. So it can be considered as the earliest marker of fetal wellbeing with Color Doppler being highly specific predictor for early detection of IUGR.

DFMC is an age old screening tool which needs minimum equipment, cost effective, easily affordable and being an inherent way of materno-fetal communication promotes high compliance, can be easily understandable to rural illiterate population, so it can be recommended as a part of routine fetal surveillance specially in high risk pregnancies like PIH and IUGR in developing countries like us. Thus Daily fetal movement count (DFMC) chart, a tool that is inexpensive, uncomplicated and non-invasive, can be a clinically effective means of screening for fetal well-being after 20 weeks gestation. But as DFMC has low specificity leading to false positive cases, is not reliable predictor for further antenatal fetal surveillance. These patients require reassessment with more technical tests of fetal wellbeing like AFI and color Doppler.

Both low AFI specifically <5cm and abnormal color Doppler were significantly associated with adverse perinatal outcome in terms of low Apgar score and increased NICU admission, IUGR fetus. But Antepartum Oligohydramnios seen to have intrapartum fetal heart rate abnormalities causing fetal distress leading to increased cesarean section and adverse perinatal outcome in terms of MSL. Also Severe polyhydramnios i.e., >35cm is associated with adverse outcomes including prematurity, SGA, low 5-min Apgar score, prenatally diagnosed congenital anomalies and perinatal mortality. These cases require intensive fetal surveillance and proper antepartum and intapartumfetal monitoring in order to improve fetal outcome.

As AFI has low specificity and low predictive value in predicting the perinatal outcome specially in high risk pregnancies and IUGR, now came the role of Color Doppler which these days proven to be more significant diagnostic method than measuring AFI. Doppler studies can identify vulnerable fetuses that are likely to exhibit the features of “fetal distress” inlabour, and that earlier intervention appears to reduce the rate of cesarean section. The role of Doppler velocimetry in differentiating the growth-restricted fetus from the “normal” small fetus has been well described. Fetal heart rate abnormalities with nonstress testing have been shown to follow abnormal Doppler findings by a median of 7 days. these interventions that reduce the rate of cesarean delivery are very welcome in our hospitals in the current climate. Also the predictive value of Doppler was seen to be increased when combined with AFI and was beneficial in perinatal prediction.

Recommendations:-

The present study highlights the importance of early antenatal registration and regular follow up of patients particularly in the rural setup. Patients should be aware of nutritional requirements, high risk factors influencing pregnancies. They should be taught regarding Daily fetal movement count and its importance and advise to report to health professionals in case of any alteration in perception of fetal movements, also regarding the impending signs of PIH, eclampsia which are main causes of IUGR and indirectly still births. Weekly sessions, posters regarding the same can be delivered in the rural setup through trained staff.

Unfortunately, there is no evidence that routine antenatal testing improves outcomes in pregnancies perceived to be low risk .Consequently, routine antenatal fetal surveillance by any imaging modality is **not** recommended in pregnancies at low risk for intrauterine fetal demise. In fact, antenatal fetal surveillance in low-risk women has the potential to cause iatrogenic prematurity secondary to preterm delivery for false-positive results. So AFS of high risk cases should be done weekly or biweekly depending upon the AFI and Doppler abnormalities and Cost should not be a hindering factor in fetal surveillance. An attempt to provide facilities of ultrasound &color Doppler at all the levels health care system irrespective of rural sector with a trained staff, would be of immense help in decreasing the avoidable still birth and thus perinatal morbidity and perinatal mortality.

At the end an important thing to conclude with is that the abnormalities in these three indices should not lead to unnecessary abdominal delivery with the possible risks of iatrogenic prematurity, rather one should plan increased and intensive fetal surveillance and appropriately timed and by appropriate mode of delivery after discussing the pros and cons of termination under the expertise of a senior obstetrician leading to a healthy baby and healthy mother.

Lets all join together to implement WHO's Every Newborn Action Plan (ENAP) to end preventable deaths and achieve still birth target of 12 per 1000 births or less by 2030.[40]

Reference:-

1. Boddy K, Dawes GS, Fisher R, Pinter S, Robinson JS. Foetal respiratory movements, electrocortical and cardiovascular responses to hypoxaemia and hypercapnia in sheep. J Physiol1974;243:599–618
2. (Level III)
3. Manning FA, Platt LD. Maternal hypoxemia and fetal breathing movements. ObstetGynecol1979;53:758–760 (Level III)
4. Murata Y, Martin CB Jr, Ikenoue T, Hashimoto T, Taira S, Sagawa T, et al. Fetal heart rate accelerations and late decelerations during the course of intrauterine death in chronically catheterized rhesus monkeys. Am J ObstetGynecol1982;144:218–223 (Level III)
5. Natale R, Clewlow F, Dawes GS. Measurement of fetal forelimb movements in the lamb in utero. Am J ObstetGynecol1981;140:545–
6. 551 (Level III)
7. Seeds AE. Current concepts of amniotic fluid dynamics. Am J Obstet
8. Gynecol1980;138:575–586 (Level III) Conway DL, Growths, Adkin WB, Langer.O. Management of isolated oligohydramnios in the teen pregnancy: A randomized clinical trial (Abstract).AmjObstetGynecol 2000; 182:s21.
9. Casey BM,Mcintire DD, Bloom SL, Lucasmj, Santos R,Twickler DM, Remus Rm. ''Pregnancyoutcomes after antepartum diagnosis of oligohydramnios at (or) beyond 34wks of gestation''. AM J ObstetGynecol 2000;909-920.
10. Junzhang J, Troendle J, Meikle S, Klebanoff MA, Ray burn W(2004)isolated oligohydramnios is not associated with adverse perinatal outcomes. BjocIII: 220-225.
11. Thomas K.Moore. et al, "Clinical assessment of amniotic fluid". J Clinics ObstetGynecol, 40 (2):303-313pp
12. Efkarpidis, S., Alexopoulos, E., Kean, L., Liu, D., & Fay, T. (2004). Case-Control Study of Factors Associated With Intrauterine Fetal Deaths. Medscape General Medicine, 6(2), 53.
13. Warrander, L. K., &Heazell, A. E. (2011). Identifying placental dysfunction in women with reduced fetal movements can be used to predict patients at increased risk of pregnancy complications. Medical Hypotheses, 76(1), 17–20.
14. Winje, B. A., Roald, B., Kristensen, N. P., &Frøen, J. F. (2012). Placental Pathology in Pregnancies with Maternally Perceived Decreased Fetal Movement - A Population-Based Nested Case-Cohort Study. PLoS ONE, 7(6), e39259.
15. Apel-Sarid L, Levy A: Placental pathologies associated fetal growth restriction; complicated with and without oligohydramnios. Arch GynecolObstet Feb 2009
16. Amniotic fluid index and perinatal outcome Stratoudakis G, Patramani S, Tzitzikalakis C, Mparmpounaki S, Xatzipetrou A, Daskalakis GDepartment of Obstetrics &Gynecology of General Hospital of Chania, Kriti, Greece, Chania, Greece 14th World Congress in Fetal Medicine
17. Ohana O, Holcberg G, Sergienko R, Sheiner E. Risk factors for intrauterine fetal death (1988-2009). J Matern Fetal Neonatal Med. 2011;24(9):1079-1083.

18. Pri-Paz S, Khalek N, Fuchs KM, Simpson LL. Maximal amniotic fluid index as a prognostic factor inpregnancies complicated by polyhydramnios. Ultrasound Obstet Gynecol. 2012;39(6):648-653.
19. Casey Brian M, Donald D McIntire: Pregnancy outcomes after antepartum diagnosis of oligohydramnios at or beyond 34 weeks' gestation. Am J ObstetGynecol, April 2000; 182(4): 909-912
20. Sadovsky Y, Christensen MW: Cord containing amniotic fluid pocketa useful measurement in the management of oligohydramnios. ObstetGynecol Nov. 1992; 80 (5):775-7.
21. Manning FA, Hill LM, Platt LD. Qualitative amniotic fluid volume determination by ultrasound: antepartum detection of intrauterine growth retardation. Am J Obstet Gynecol. 1981;139(3):254– 8
22. Chhabra S, Dargan R : Oligohydramnios - a potential marker for serious obstetric complications. J ObstetGynecol Oct 2007; 27(7):680-3
23. Chamberlin PF, Manning FA et al: Ultrasound evaluation of amniotic fluid volume. The relationship of marginal and decreased amniotic fluid volume to perinatal outcome. Am J ObstetGynecol 1984; 150:245.
24. Yoon BH, Lee CM, Kim SW. an abnormal umbilical artery waveform; a strong and independent predictor of adverse perinatal outcome in patients with pre eclampsia – American journal of obstetrics and gynecology 1994; 171:713-721.
25. Gerber S, Hohlfeld P, Viquerat F, Tolsa JF, Vial Y. Intrauterine growth restriction and absent or reverse enddiastolic blood flow in umbilical artery (Doppler class II or III): A retrospective study of short- and long-term fetal morbidity and mortality. Eur J ObstetGynecolReprod Biol. 2006;126(1):20-26.
26. Mandruzzato GP, Bogatti P, Fischer L, Gigli C. The clinical significance of absent or reverse end-diastolic flow in the fetal aorta and umbilical artery. Ultrasound Obstet Gynecol. 1991;1(3):192-196.
27. Figueras F, Cruz-Martinez R, Sanz-Cortes M, et al. Neurobehavioral outcomes in preterm, growth-restricted infants with and without prenatal advanced signs of brain-sparing. Ultrasound Obstet Gynecol. 2011;38(3):288-294.
28. Pregnancy at Risk Current Concepts, (FOGSI). Jaypee Bros.; 2001.
29. Khan DB, Bari V, Chishty IA. Ultrasound in the diagnosis and management of intrauterine growth retardation. J Coll Physicians Surg Pak. 2004;14(10):601–4.
30. Ott WJ. current prespective in antenatally surveillance ultrasound. Rev
31. Obst Gynecol. 2003;3:1–180.
32. Johnson JM, Chauhan SP, Ennen CS, Niederhauser A, Magann EF. A comparison of 3 criteria of oligohydramnios in identifying peripartum complications: a secondary analysis. Am J ObstetGynecol 2007;197(2):207.e1-7.
33. Sriya R, Singhai S. Perinatal outcome in patients with amniotic fluid index < 5cm. J ObstetGynaecol India 2001;51:98-100
34. Philipson EH, Sokol RJ, Williams T. Oligohydramnios: Clinical Associations and Predictive Value for Intrauterine Growth Retardation. Am J ObstetGynecol 1983;146(3):271-278
35. Yoon BH, Lee CM, Kim SW. an abnormal umbilical artery waveform; a strong and independent predictor of adverse perinatal outcome in patients with pre eclampsia – American journal of obstetrics and gynecology 1994; 171:713-721.
36. RCOG IUGR Guideline.
37. Vidyadhar B. Bangal, Purushottam A. Giri, Bhushan M. SaliBangal V B et. al. / JPBMS, 2011, 12 (05)
38. Hitschold T, Weiss E, Berle P, Muntefering H. Histologic placenta findings in prolonged pregnancy: correlation of placental retarded maturation, fetal outcome and Doppler sonographic findings in the umbilical artery. Z GeburtshilfePerinatol 1989;193(1):42–6
39. Kwon JY, Kwon HS, Kim YH, Park YW. Abnormal Doppler Velocimetry is related to adverse perinatal outcome for borderline amniotic fluid index during third trimester. J ObstetGynecol Res 2006:32(6):545-49
40. Chauhan SP, Hendrix NW: Intrapartum oligohydramnios does not predict adverse peripartum outcome among high risk parturient. Am J ObstetGynecol, 1997; 176(6):1130-1136.
41. Golan A, Lin G: Oligohydramnios - maternal complications and fetal outcome in 145 cases. GynecolObstet Invest 1994; 37(2):91-5.
42. Mercer Lane, L.G. Brown: A survey of pregnancies complicated by decreased amniotic fluid. Am J ObstetGynecol 1984; 149:355-361.
43. who. http://www.who.int/maternal_child_adolescent/epidemiology/ stillbirth/en