OBSTETRICAL OUTCOMES IN WOMEN WITH ISOLATED OLIGOHYDRAMNIOS AT TERM

By

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Dissertation submitted to Sri Devaraj Urs Academy of Higher Education And Research, Kolar, Karnataka
In partial fulfillment of the requirements for the degree of

MASTER OF SURGERY
IN
OBSTETRICS AND GYNAECOLOGY

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I hereby declare that this dissertation entitled **"OBSTETRICAL OUTCOMES IN WOMEN WITH ISOLATED OLIGOHYDRAMNIOS AT TERM"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. Gomathy.E,** Professor, Department of Obstetrics and Gynecology and **Dr. Sudha Reddy V.R**, Professor, Department of Pediatrics, Sri Devaraj Urs Medical College, Tamaka, Kolar.

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Dr. POONGUZHALI LISTON

LIST OF ABBREVATIONS USED

ACOG	: American College of Obstetricians and Gynecologists
AFI	: Amniotic Fluid Index
AFV	: Amniotic Fluid Volume
BPP	: Biophysical Profile
CST	: Contraction Stress Test
CTEV	: Congenital Talipes Equino varus
CTG	: Cardiotocography
CVS	: Chorionic Villous sampling
EFM	: Electronic Fetal Monitoring
FAST	: Fetal Acoustic Stimulation Test
FGR	: Fetal Growth Restriction
FHR	: Fetal Heart Rate
IUGR	: Intra Uterine Growth Restriction
LSCS	: Lower Segment Ceasarean Section
MBBP	: Modified Biophysical Profile
MVP	: Maximum Vertical Pocket
NST	: Non Stress Test
PNM	: Perinatal Mortality
PROM	: Premature Rupture of Membrane
USG	: Ultrasonogram
VAST	: Vibro Acoustic Stimulation test

ABSTRACT

INTRODUCTION:

Oligohydramnios is a serious complication of pregnancy that is associated with a poor perinatal outcome. Phelan defined oligohydramnios as amniotic fluid index (AFI) < 5cm from 36-42 wks of gestation. It occurs in about 1-5% of pregnancies at term. In pregnancies >40wks of gestation, the incidence may be >12% as the amniotic fluid volume declines progressively after 41 wks of gestation. Isolated oligohydramnios at term is defined as AFI <5 cm without any maternal or fetal complications. Incidence of isolated oligohydramnios is 0.5-1 % at term.

AFI assessed in antenatal period will help to identify women who need increased surveillance for pregnancy complications. It can also be used as an adjunct to other fetal surveillance method to identify those infants at risk of poor perinatal outcome.
The number of studies dealing with isolated oligohydramnios at term and its outcome in Indian setup is limited.

Therefore this study is conducted to determine the obstetric outcome in uncomplicated pregnancies with low AFI at term coming to R.L.JALAPPA HOSPITAL, Kolar.

METHOD:

It consists of analysis of pregnancy outcome in 50 cases with diagnosis of oligohydramnios by ultrasound after 37 completed weeks of gestation compared with 50 controls with no oligohydramnios and matched for other variables like age, parity, gestational age. There are some inclusion and exclusion criteria mentioned in brief later. Various outcome results were recorded and tabulated. The results were statistically analysed using parameters like mean, standard deviation and chi square test.

RESULTS:

There was significant difference between two groups in delivery by LSCS for fetal distress (0.04) that too among patients with AFI 0-1 (0.04). There is increased incidence of labour induction in women with AFI ≤5cm than women with AFI >8cm. (p-0.01)

CONCLUSION:

An amniotic fluid index of ≤ 5cm detected after 37 completed weeks of gestation is an indicator of poor pregnancy outcome. Determination of AFI can be used as an adjunct to other fetal surveillance methods

KEYWORDS:

Amniotic fluid, AFI, Isolated oligohydramnios, Non-stress test, fetal cord blood pH, perinatal outcomes.

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INTRODUCTION

Amniotic fluid plays a major role in the fetal growth and development. It provides the fetus with a protective environment suitable for growth and development. It acts like a cushion against the constricting confines of the gravid uterus, allowing the fetus room for movement and growth .It also protects it from external trauma. It helps to maintain the fetal body temperature and plays a part in the homeostasis of fluid. It permits extension of the limbs thus preventing joint contractures. It protects against compression of the umbilical cord and thus protects the fetus from vascular and nutritional compromise.

Therefore abnormalities of the fluid volume can interfere directly with fetal development or it may be an indirect sign of underlying disorder such as fetal hypoxia, neural tube defect or gastro intestinal obstruction.

In the past the discussions of amniotic fluid volume were limited to observations of the quantity of fluid released after rupture of membranes.

However the importance of amniotic fluid volume as an indicator of fetal status was only appreciated recently.

Before the advent of ultrasound clinicians had to rely on abdominal palpation and symphysio-fundal height measurements to detect abnormal fluid volume. For oligohydramnios and polyhydramnios to be detected by clinical examination the condition has to be severe. With the development of ultrasound imaging the amniotic fluid volume assessment has progressed from a stage of subjective impression to the present state of reproducible measurements which can be used to judge the fetal condition.

In present practice, a semi quantitative amniotic fluid volume assessment during routine ultrasound examination and ante partum testing has become the standard of care. AFI assessed in antenatal period will help to identify women who need increased surveillance for pregnancy complications. It can also be used as an adjunct to other fetal surveillance method to identify those infants at risk of poor perinatal outcome.

Oligohydramnios is a serious complication of pregnancy that is associated with a poor perinatal outcome. Phelan defined oligohydramnios as amniotic fluid index (AFI) < 5cm from 36-42 wks of gestation[1].It occurs in about 1-5% of pregnancies at term[1].

In pregnancies >40wks of gestation, the incidence may be >12% as the amniotic fluid volume declines progressively after 41 wks of gestation. Isolated oligohydramnios at term is defined as AFI <5 cm without any antenatal maternal or fetal complications .Incidence of isolated oligohydramnios is 0.5-5 % at term.

The etiology, management and the outcome is different in late onset oligohydramnios compared to early onset oligohydramnios.

Many studies show that oligohydramnios is associated with variety of ominous pregnancy outcomes, such as fetal distress, low birth weight, perinatal morbidity, perinatal mortality and increased incidence of caesarean section.

However, the above observation is refuted by studies that prove amniotic fluid index is a poor predictor of adverse outcome and even the existence of an entity like isolated term oligohydramnios has been questioned by some authors. Thus this study is conducted to determine whether an antepartum amniotic fluid index (AFI) of 5 cm or less can be used as a predictor of adverse pregnancy outcome

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The amniotic fluid that surrounds the fetus serves several roles during pregnancy. It creates physical space for musculoskeletal development, promotes normal fetal lung development and helps to avert compression of the umbilical cord.[1]

The amniotic fluid volume at each week of pregnancy is variable. It increases from 20ml at 10 weeks to 770ml at 28 weeks, remains at a steady state till 39 weeks, after which decreases dramatically. The average Amniotic fluid volume in third trimester is 700-800 ml[1].

There are various methods to assess the amniotic fluid index. Clinical assessment of amniotic fluid volume includes bimanual palpation, symphysio fundal height, which are unreliable. Diagnosis is generally made by measuring the Amniotic fluid compartment using ultrasound.

Phelan described amniotic fluid index and defined oligohydramnios as AFI less than 5, [1] but later Jeng et al proposed a cut off of 8 demonstrating increased incidence of meconium staining ,caesarean section delivery for fetal distress ,abnormal APGAR scores of 7 or less at 1 minute when AFI was less than 8. [2]

Oligohydramnios when associated with other high risk factors such as multiple gestation, chronic maternal hypertension, gestational diabetes is a good predictor of adverse outcome.

In a retrospective chart review conducted by Chamberlain and co-workers ,the amniotic fluid volume as determined at the time of last biophysical profile score assessment was compared to perinatal outcome in 7583 referred high risk obstetric patients was done . Gross and corrected perinatal mortality in association with normal qualitative amniotic fluid volume ranged from 4.65/1000 and 1.97/1000, respectively, to 187.5/1000 and 109.4/1000 in association with decreased qualitative amniotic fluid volume, respectively.[3]

A study of prolonged pregnancies showed that patients with reduced amniotic fluid had a statistically significant increase in meconium stained amniotic fluid and growth retarded babies and were more likely to require delivery by caesarean section for fetal

distress. There were no perinatal deaths in the series and the perinatal outcome was satisfactory in both groups. Ultrasound measurement of amniotic fluid represents an effective discriminatory test in postterm pregnancies.[4]

Manning et al. (1986) defined severe oligohydramnios as a condition in which the largest pocket of amniotic fluid measures less than 1 cm in its vertical axis as determined by an ultrasound method, was observed in 113 patients in a population of 15,431 referred high-risk patients (0.7%). In all cases, intervention took place unless there was a recognized structural anomaly or extreme prematurity. Overall gross perinatal mortality was 132.7/1000, and the incidence of major anomaly was 13.3%. With intervention the corrected perinatal mortality rate was 17.7/1000, a rate not significantly different from that observed in the entire population. All end points of perinatal mortality were significantly increased in patients with severe oligohydramnios, in comparison with randomly selected control subjects with normal amniotic fluid. [5]

In a study by Brace R.A. and Wolf et al. (1989) of 705 cases, the fluid trends in pregnancy were:

- Amniotic fluid volume rises progressively until approximately 32 weeks.
- After 40 weeks there is progressive decline in amniotic fluid volume at a rate of 8% averaging about 400ml at 42 weeks. [6]

It has been elicited that any qualitative and quantitative changes in amniotic fluid is associated with changes in NST. Oligohydramnios is characterized by variable decelerations, which is due to the compression of cord.

Rutherford et al (1987) assessed amniotic fluid volume using a semi quantitative four quadrant technique and the AFI was evaluated in relationship to fetal heart rate testing and perinatal morbidity in 330 high risk pregnancies. An inverse relationship was found between the AFI and non-reassuring non stress test, FHR decelerations, meconium staining, caesarean section for fetal distress and low APGAR scores. More important, adverse perinatal outcome was significantly more frequent with diminished compared to normal amniotic fluid volume, even if the NST was reassuring. [7]

A study in 1991 interpreted the variable deccelerations noted during NST by adding estimation of amniotic fluid volume. The incidence of caesarean delivery for intrapartum fetal distress progressively increased coincidentally with severity of variable decelerations and diminished amniotic fluid volume. Severe variable deceleration during NST with AFI of 5cm or less resulted in 75% caesarean rates. [8]

An Indian study in 1991 evaluated amniotic fluid index and its relationship to fetal heart rate and perinatal morbidity in 415 obstetric patients at term. An inverse relationship was found between AFI and NST, FHR decelerations and caesarean sections for fetal distress. The important finding was that, adverse perinatal outcome was significantly more frequent with severity of oligohydramnios, even if the NST was reassuring. [9]

Reduced AFI has been found to be associated with adverse obstetric and perinatal outcome in terms of increase in caesarean sections, preterm birth, reduced APGAR, meconium aspiration and increase in NICU admissions.

Grubb et al. (1992) in a study found that decreased amounts of amniotic fluid have been associated with adverse fetal outcome. Women with an AFI less than 2cm had operative intervention for fetal distress in 7 to 11 cases (64%) compared with 17 of 81(21%) who had an AFI of 2cm or more (p=0.005). [10]

Nageotte et al. (1994) concluded that the modified biophysical profile is an excellent means of fetal surveillance and identifies a group of patients at increased risk for adverse perinatal outcome and small for gestational age infants.[11]

In 1995 a study conducted compared pregnancies with AFI < 5 cm and those between 8.1 - 20cm detected on routine intrapartum amniotic fluid volume assessment. The variable decelerations and caesarean delivery for fetal distress occurred significantly more often in oligohydramnios group. However, meconium stained amniotic fluid occurred significantly less often in oligohydramnios. There was no difference in APGAR score or neonatal complications between two groups. [12]

Weiner et al. (1996) carried out a study of central and peripheral haemodynamic changes in postterm fetuses and its correlation with oligohydramnios and abnormal FHR pattern. Post term fetuses with an abnormal AFI had significantly lower aortic peak velocity compared with post term fetuses with normal AFI. It was concluded that oligohydramnios and abnormal FHR pattern in post term fetuses appear to be associated with impaired cardiac functions. [13]

A study conducted by Ergun A and co-workers,amniotic fluid volumes were measured in 1,659 pregnant women to determine the predictive value of these measurements on perinatal outcome. All cases were evaluated by other 8 tests of fetal well-being. 128 cases were oligohydramniotic, and 1,531 cases were normal. In all cases, several parameters were assayed, e.g. fetal distress, way of delivery, meconium in amniotic fluid, APGAR score, transfer to paediatric clinics and early-late neonatal complications. The results were as follows: assessing fetal distress: specificity 94.2%, sensitivity 18.4%, positive predictive value 35.9%, negative predictive value 86.7% and accuracy 82.8%, and assessing low APGAR score the values were 93.0, 21.3, 95.9 and 89.5%, respectively. It was concluded that AFV is an important parameter predicting perinatal outcome, and its predictive value increases if it is combined with other fetal well-being tests with different end points. [14]

When Oligohydramnios is present with no other associated maternal or fetal abnormalities ,it is known as isolated oligohydramnios .In most cases isolated oligohydramnios is not associated with adverse outcomes .Hence the use of isolated oligohydramnios as a predictive test for adverse obstetric outcome is debatable .As the line of management for oligohydramnios at term is termination of pregnancy ,it is paramount importance to differentiate cases of isolated oligohydramnios from oligohydramnios associated with complication in order to prevent unnecessary caesareans and to improve the perinatal outcomes .

Conway et al. (1998) has questioned whether the isolated oligohydramnios in term pregnancies is a clinical entity and have concluded that isolated oligohydramnios in otherwise normal term pregnancy does not necessarily indicate fetal compromise. Thus in most women with isolated oligohydramnios labour induction may not be warranted as it merely increases the rate of caesarean section. [15]

A review of 42 reports on amniotic fluid index published between 1987 and 1997 concluded that AFI of 5 cm or less significantly increases the risk of either LSCS for fetal distress or low 5 min APGAR score (< 7). [16]

A study of 1001 patients at risk, undergoing antenatal testing concluded that, the current ultrasonographic measurement with amniotic fluid index and 2 diameter pocket technique are poor diagnostic tests to determine whether a patient is at high risk for an adverse perinatal outcome. In their study about 20% of pregnancies studied had AFI less than 5 cm. They concluded that amniotic fluid index was a poor screening criterion to determine adverse perinatal outcomes.[17]

In a case control study of 79 women matched for pregnancy complications with an AFI of < 5 cm and > 5 cm found that the two groups did not differ significantly in their risk for thick meconium, variable decelerations, amnioinfusion, caesarean delivery for fetal distress or umbilical artery pH less than 7.1. [18]

A study in 2000 used AFI for fetal surveillance and showed amniotic fluid volume assessment is very helpful in predicting the perinatal outcome. The incidence of birth asphyxia, neonatal complications, low 5 min APGAR score, LSCS for fetal distress were increased and mean birth weight was low. AFI had sensitivity, specificity, positive predictive value and negative predictive value of 76.92%, 73%, 50%, 99% respectively in predicting caesarean section for fetal distress. [19]

Casey and colleagues in a retrospective analysis of 6423 pregnancies managed; found that AFI < 5 cm was associated with increased perinatal morbidity and mortality. [20]

An Indian study in 2001 was conducted to determine the value of routine amniotic fluid volume assessment at term on perinatal outcome. An increased incidence of meconium stained amniotic fluid, caesarean delivery for fetal distress, low birth weight and low APGAR scores were observed in the AFI < 5 cm group. Therefore this as concluded to be a valuable test for predicting adverse outcome.[21]

In a 2006 study, 180 women between 37 and 42 weeks' gestation who were admitted for induction of labour were divided into 2 groups: the women in one group had an AFI ≤5 cm (n = 66) and the women in the other group had an AFI of >5 cm. Although the 2 groups had comparable demographic and obstetric characteristics prior to induction, the women in the low AFI group had an increased rate of caesarean section secondary to fetal distress. [22]

A retrospective study in 2007 evaluated the outcome of active induction of labour for isolated oligohydramnios in low-risk term gestation. Two groups were compared: 206 deliveries after induced labour for isolated oligohydramnios, and 206 deliveries matched for gestational age following spontaneous labour with normal amniotic fluid index. They concluded active induction of labour in term low risk gestations with isolated oligohydramnios translated into higher labour induction, operative vaginal delivery and caesarean section rates. This led to increased maternal risk and an increase in costs of management with no differences in neonatal outcome.[23]

A study was conducted to compare the use of the amniotic fluid index with the single deepest vertical pocket measurement as a screening tool for decreased amniotic fluid volume in preventing adverse pregnancy outcome. They concluded that single deepest vertical pocket measurement in the assessment of amniotic fluid volume during fetal surveillance seems a better choice since the use of the amniotic fluid index increases the rate of diagnosis of oligohydramnios and the rate of induction of labor without improvement in peripartum outcomes. [24]

In a study conducted in Sullia, in the year 2012, 100 singleton pregnancies with > 37 weeks of gestational age were studied. In conclusion it was found that isolated oligohydramnios does not adversely affect the fetal outcome, though the fetal weight may be slightly lower in babies born to mothers with oligohydramnios. The incidence of caesarean section for fetal distress was higher in patients with oligohydramnios as seen in earlier studies.[25]

A study conducted in Aga Khan University aimed to elicit the effect of isolated Oligohydramnios on perinatal out come and they concluded that isolated oligohydramnios

is not associated with adverse perinatal outcomes, but there was an increase in labour induction and caesarean deliveries. [26]

A systematic review was conducted in 2013 to compare the pregnancy outcomes in term and post term isolated oligohydramnios and pregnancies with normal AFI .It was concluded that though the incidence of operative interventions were higher in term /Post term isolated oligohydramnios ,all other outcomes were comparable to that of pregnancies with normal AFI. [27]

In a study done in Arizona USA in the year 2014, the perinatal outcome in 177 women with borderline oligohydramnios was compared with outcome in 562 women with normal AFI .It was concluded that there was no difference in fetal intolerance for labour in both the groups.Women with borderline AFI needed more antepartum surveillance and the rate Caesarean section was more in the study group.[28]

A study published in 2015 compared the perinatal outcomes and the mode of delivery in 50 patients with isolated oligohydramnios and 50 cases with normal AFI .It was concluded that in the group with isolated oligohydramnios there was higher incidence of non-reassuring NST, caesarean section, low APGAR,higher NICU admissions for fetal distress and lower fetal birth weight.[28]

In a study conducted on180 pregnant women in Nasik in the year 2013, it was concluded that Low AFI at term was a predictor of adverse preinatal outcome like Low Apgar, more number of NICU admission and lower birth weight.[29]

An Indian study published in 2015 compared the obstetrics outcome in women with isolated oligohydramnios and women with normal AFI.It was concluded that except for the increase in rate of operative intervention there was no significant difference in perinatal outcome of both the groups.[30]

A study conducted in Rajasthan in the year 2015, perinatal outcome in 100 women with term oligohydramnios was compared to 100 women with normal AFI .It was concluded that an AFI < 5 was associated with adverse outcomes such as risk of meconium stained

liqour, increased operative deliveries and increased caesearean section .Thus low AFI can be used as a predictor of adverse maternal and neonatal outcome .[31]

A study conducted in 2016 aimed to compare the perinatal outcome in patients with isolated oligohydramnios and normal AFI post labour induction at term .It was concluded that the outcomes were comparable in both groups post induction.[32]

A study was conducted in Madhya Pradesh involving 200 pregnant women.The maternal and neonatal outcome in women with term oligohydramnios was compared to that of women with normal AFI. It was concluded that AFI <5 is a good predictor of poor perinatal outcome .There was significant increase in the number of caesareans and lower APGAR score among women with Oligohydramnios. [33]

AMNIOTIC FLUID

It is a clear fluid collected in the amniotic cavity surrounding the fetus. The colour & composition varies slightly with gestation age.

Physical features:

1. **pH:** Slightly alkaline (7.2) especially in the later part of Pregnancy.
2. **Osmolality:** At term amniotic fluid becomes highly hypotonic to maternal serum. This is thought to be due to addition of highly hypotonic fetal urine Osmolality = 250 mmol/L
3. **Colour:** During the normal course of pregnancy the color of the amniotic fluid changes.

Normal Colour:

a. Less than 20 weeks-straw colour to deep yellow depending upon the amount of bilirubin present.

b. After mid-pregnancy the concentration of bilirubin decreases & by 36 weeks the normal amniotic fluid is virtually colourless.

c. During the last 4-5 weeks white floccules may appear in the fluid. These are clumps of desquamated fetal skin cells & free liquid material (vernix caseosa).

Abnormal colour:

a. Meconium stained (green): Suggests fetal distress in presentation other than breech presentation / transverse.

b. Golden colour: This is due to bilirubin in excess. High bilirubin levels after 30 weeks is abnormal and excessive hemolysis due to Rh incompatibility should be considered.

c. Greenish yellow (Saffron): Indicates post maturity.

d. Dark colour: Seen in concealed accidental hemorrhage and due to contamination of blood.

e. Dark brown (Tobacco juice colour) amniotic fluid in IUD.

Composition:

As the mechanism of amniotic fluid production changes during the course of pregnancy ,the composition of the fluid also changes..

In the first half of the pregnancy the composition of the fluid is almost identical to a transudation of plasma. But in late pregnancy the composition is very much altered.

The composition includes:

1. Water 98-99%
2. Solid 1-2%

Solid constituents near term include:

Organic

Protein	:	0.3 gms% -0.5 gms%
Non protein nitrogen	:	24-30 mg%
Glucose mg%	:	20
Urea	:	30mg%
Uric acid mg%	:	4-5
Creatinine	:	2 mg%
Total lipids	:	50mg%

Hormones

The concentration of these substances gradually increase as pregnancy advances as it is contributed by fetal urine.

Inorganic

The concentration of electrolytes in amniotic fluid is essentially the same as that of the maternal blood. As the pregnancy advances, there is fall in the concentration of sodium and chlorides but potassium levels remain the same throughout.

Suspended particles:

This includes lanugo, exfoliated squamous epithelial cells of skin, vernix caseosa, cast off amniotic cells and cells of fetal respiratory tract, urinary bladder and vagina of the fetus.

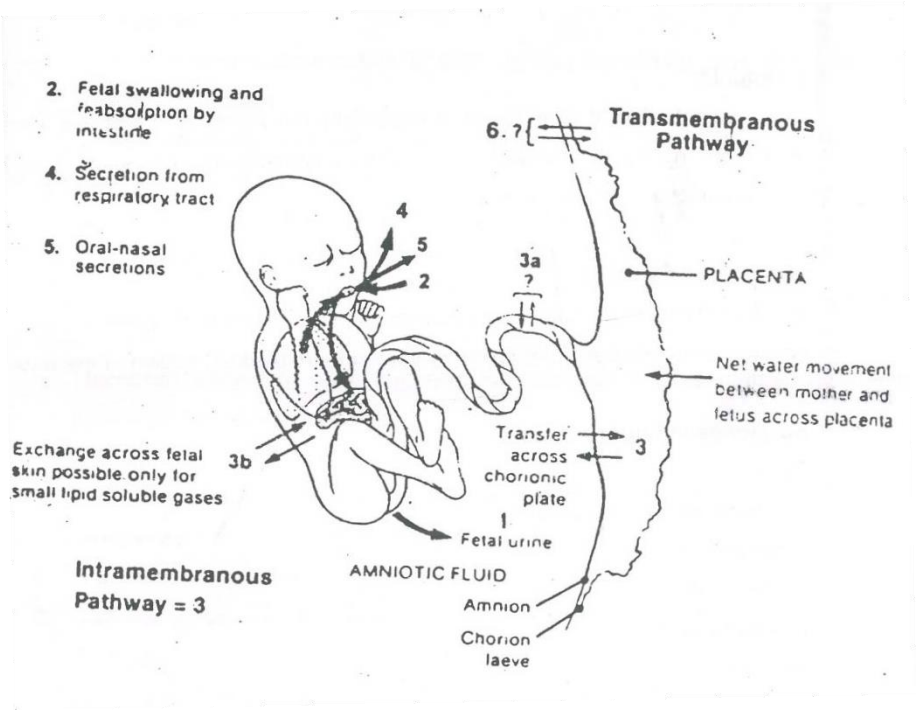
Hormones in liquor amnii:

- Cortisone
- hCG
- hPL
- 17-Ketosteroid
- Oestriol
- Progestrone derivatives.

Formation of amniotic fluid

The mechanism of amniotic fluid production, resorption, composition and volumes of amniotic fluid present depends on gestation age. During first trimester the major source of amniotic fluid production is the amniotic membranes. Water cross the membrane freely with no active transport mechanism, therefore the rate of production of fluid in the amniotic cavity depends on active transport of electrolytes and other solutions by the amnion.The amnion may also synthesize proteins for secretion into the amniotic cavity.

Fig No 1: SCHEMATIC REPRESENTATION OF PATHWAYS AMNIOTIC FLUID FORMATION & RESORPTION



During the latter half of the 1st trimester and the early 2nd trimester, as the fetus and placenta differentiate, develop and grow, other pathway for amniotic fluid production and resorption comes into play. These include movement of fluid across the chorion frondosum and fetal skin, fetal urine output and fetal swallowing and gastro intestinal absorption.

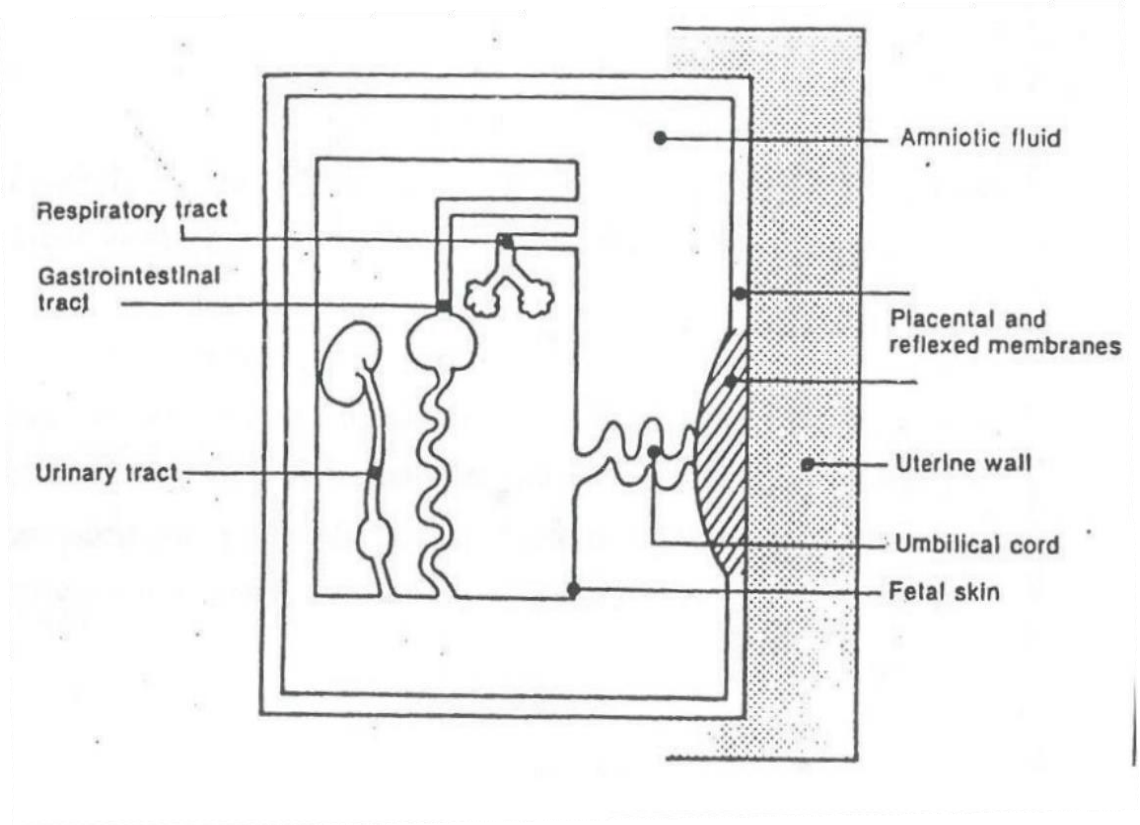
The chorion frondosum, is the portion of the chorion that develops into the fetal portion of the placenta, is also a site at which water is exchanged freely between fetal blood and amniotic fluid across the amnion. Fetal skin is permeable to water and some solutes permitting direct exchange between the fetal and amniotic fluid until keratinization occurs at 24-26 weeks of gestation. However, the fetal skin continues to play a role in volume regulation throughout pregnancy. The importance of this pathway is evident in the significantly higher transcutaneous fluid losses of preterm infants.

With the development of excretory system the fetal urine becomes the major determinant of amniotic fluid volume. Fetal urine production begins at 8-10 weeks gestation and becomes a major pathway for amniotic fluid production from the mid 2^{nd} trimester. The idea that fetal urine is the major source of amniotic fluid has been long accepted based largely on the observations that anephric fetuses with obstruction of urinary tract have reduced amniotic fluid after the middle of 2^{nd} trimester.

The fetal respiratory system also provides a mechanism for production and consumption of amniotic fluid, although the exact contribution of this system is not widely studied. Previously, it was believed that the fetal lungs absorbed amniotic fluid. It has been now determined that mammalian fetal lungs secrete large amounts of fluid each day under normal conditions with a decrease in secretions beginning at the time of labour and delivery. Only under conditions of fetal asphyxia or severe distress do the fetal lungs absorb fluids. Tracheal ligation caused gross over distension of fetal lungs in mammalian examples. This observation has led to a gradual acceptance of fluid secretion rather than absorption being the normal process in the fetal lungs. Another supporting observation is that, although meconium staining of amniotic fluid is common, aspiration of meconium into the lungs of the newborn is relatively uncommon.

Fetal surface of the placenta may be another site of not only water absorption from the amniotic sac but as a major source of solutes in the amniotic fluid .Apart from these, there is an additional small contribution to the fluid volume due to secretion from the fetal oral- nasal cavities.

Fig No 2: PATHWAY FOR FLUID MOVEMENT OUT OF THE AMNIOTIC SAC



During the first trimester, the fluid exchange both in and out occurs through the amniotic membrane. During the latter half of gestation there are two primary routes of clearance of amniotic fluid.

The first one is fetal swallowing.

The occurrence of fetal swallowing has been recognized recently. Based on the presence of epidermal debris including lanugo hairs in meconium it has been suggested for more than 70 years that fetal swallowing occurs in uterus. However, it was not until 30 years ago when Pritchard provided a quantitative estimate of the volume swallowed each day the concept of fetal swallowing in uterus became generally accepted. Esophageal ligation of fetal monkeys resulted in acute polyhydramnios and esophageal occlusion of fetal sheep produced an acute increase in ovine AFV.

The other primary route of amniotic fluid removal is by absorption into the fetal blood perfusing t h e fetal surface of the placenta.

The other pathways for exchange are:

1. **Trans-membranous pathway**: Exchange occurs between amniotic fluid and maternal blood within the uterine wall.
2. **Intra membranous Pathway**: Exchange occurs between amniotic fluid and fetal blood.
    - Within the fetal surface of the placenta.
    - Across the fetal skin
    - Across the umbilical cord.

Thus there are a total six routes by which water and solutes may enter and /or leave the amniotic compartment.

Flow through the specific pathways:

For the six potential pathways described above, quantitative estimation of daily volume flow in human fetuses across different gestation is available only for urinary output. Ultrasound imaging of the urinary bladder in three dimension allowed the urinary flow rate to be calculated from changes in the bladder volume at a given time. The volume of urine produced daily by the human fetus during the latter half of gestation is about 30% of body weight. At 25 weeks the fetus produces approximately 100 ml of urine daily, with production increasing to about 600ml/day by term and then declining somewhat after 40 weeks of gestation.

The volume of fluid swallowed daily by the human fetus has been estimated in very few studies. Pritchard in 1965 injected radioactive chromium labeled erythrocytes into the amniotic fluid and measured the chromium content in amniotic fluid at caesarean section and chromium recorded from infant diapers during the first 5 days of life. Results showed that the term fetus swallows 155 ml/kg/day.

In 1970, Abramovich injected colloidal gold intraamniotically throughout gestation. According to him 18 weeks fetus swallows 18-50ml/kg/day. While near term fetus swallows 68 ml/kg/day.[34]

The study of fetal swallowing based on the disappearance of amniotically injected

tracers has a disadvantage that it does not include the considerable volume of lung fluid swallowed. Fetal swallowing is estimated to be 15% of body weight which is considerably less than daily urine production of 30 ml/day.

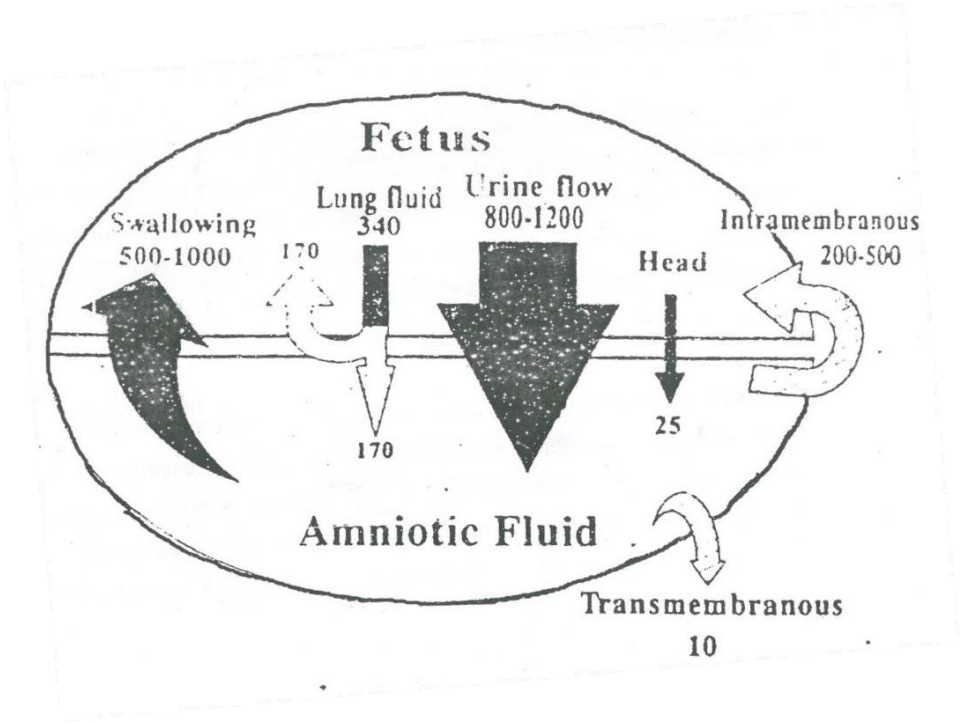
Even less is known about lung liquid secretion rate. No measurements have been made in human fetuses. In fetal sheep during the latter half of gestation the secretion rate is approximately 10% of the body weight. The secretion process is regulated by a variety of hormones including catecholamines, cortisol and arginine, vasopressin among others. The influencing factors tend to suppress secretion. Overall, animal studies suggest that an average of half of the fluid secreted by the lungs enter the amniotic compartment which is equivalent to 5% of body weight.

Estimation of intra membranous flow is available only from studies conducted on fetal sheep. Experimental studies with water injection into the amniotic compartment during simultaneous fetal urine drainage plus esophageal obstruction suggested that 200ml of water was absorbed intra membranous in 3 kg fetuses daily. In another study which was to study intramembranous absorption under physiological conditions, explored the changes in amniotic osmolality with time in response to fetal urine drainage plus simultaneous trachea esophageal occlusion (i.e during elimination of all major amniotic flows except intra membranous) under those conditions, it was calculated that 240 ml daily of amniotic water were absorbed intramembranously. However, this calculation did not correct for the decrease in osmotic gradient with time. This correction estimates 400ml daily of water absorption intra membranously.

The two remaining flows are oral – nasal secretions and transmembranous volume flow. This has been estimated to be about 10ml/ day.

Finally, hormones play a role in amniotic fluid regulation. For example, intra amniotic injection of prolactin has shown to reduce amniotic fluid volume by 50%. A simultaneous decrease in maternal haematocrit indicates that prolactin stimulates the transport of water from fetal to maternal compartment. Cortisol and ADH affect the permeability of amnion. There is also a strong correlation between maternal plasma volume and amniotic fluid volume i.e. an elevated maternal plasma volume is associated with polyhydramnios and decreased plasma volume with oligohydramnios.[35]

Fig No 3: SUMMARY OF WATER FLOW INTO AND OUT OF THE AMNIOTIC SPACE IN LATE GESTATION



PHYSIOLOGY OF AMNIOTIC FLUID VOLUME REGULATION

Despite the complex osmotic & hydro dynamic forces involved, amniotic fluid volume is regulated with in a surprisingly narrow range. Even after decades of investigation, the regulation of amniotic fluid volume remains enigmatic. This is in fact because of the complexities inherent in amniotic fluid dynamics: a complex interaction of several sites of fluid excretion and acquisition.

Late in gestation 1000ml of fluid daily flows into the amniotic compartment & same amount daily leaves the compartment and even a minor to moderate aberration in flows during a period of days or weeks can readily lead to oligohydramnios or polyhydramnios. There is no known sensors for AFV, which could be a part of a control loop to return AFV towards normal whenever it becomes too high or too low. On the other hand fetal urine flow, lung liquid secretion and swallowing are all known to be regulated. In addition, intra membranous absorption is undoubtedly regulated by the factors that control intra membranous permeability and surface area. Thus, all of the primary flows into and out of the amniotic compartment are regulated and it may be the interaction among these flows that provide the regulation of AFV.

Some studies have suggested that even slight changes in intra membranous permeability can have very large effect on intra membranous flux. Clearly, any substance like prostaglandins, which enters the amniotic fluid, could potentially alter intra membranous permeability and thus lead to alterations in AFV. The prostaglandins could be excreted into amniotic fluid by fetal kidney, secreted by fetal lungs or released by the amnion or chorion. Another possibility is that the ultimate controller of AFV may be the placental transfer of water and solutes to and from the fetus. Under normal conditions, the fetal kidneys are extremely capable of transferring huge amounts of exogenous water and / or salts to the amniotic compartments. Maternal dehydration causes reduction in AFV by maternal fetal interaction across the placenta. The increase in AFV by drinking 2 litres of water per day could also be mediated by changes in intra membranous flow because the water – induced reduction in fetal osmolality would be expected to reduce intramembranous absorption. In general the conditions which impairs the placental function will result in oligohydramnios. But hypoxic hypoxia as in pregnant women living at 6000 feet is more commonly associated with polyhydramnois. The reason for this is unknown. This could probably be due to suppression of fetal swallowing.

Overall, it is clear that a great deal more information is needed before the regulation of AFV can be completely and comprehensively understood.

Changes in AFV across gestation

From the time, of formation of the amniotic sac in embryonic life the volume of amniotic fluid progressively increase during most of the gestation but typically decreases at term and even becomes severely reduced post term.

Although there are fairly wide variations, amniotic fluid measures about 10-20 ml at 10 weeks, 50ml at 12 weeks, 400ml at 20 weeks and 700 ml at the beginning of the third trimester and reaches its peak of nearly one litre at 32-38 weeks and decreases to 800 to 900 ml at term. However, in some the amniotic fluid volume continues to increase until 40 weeks gestation and in some cases it remains constant. The range of amniotic fluid volume for a given gestation age is quite large. Across 95% AFVs are within the range of 1.57-2.57 times the mean gestation age.

A recent study provides a coherent description of amniotic fluid volumes during

gestation. This review analysed 705 determinations of AFV in normal pregnancies between 8 and 43 weeks gestation in 12 published studies. All the measurements were based on either direct quantification of fluid collected at hysterotomy or indicator-dilution of AFV. From the data collected, they plotted the relationship between AFV and gestational age. It was determined that AFV progressively increased during gestation until approximately 33 weeks. They plotted a graph of amniotic fluid volume as a fraction of gestation age. The curve in the graph provides a benchmark against which noninvasive clinical method can be compared.[7]

From this composite graph several facts are evident:

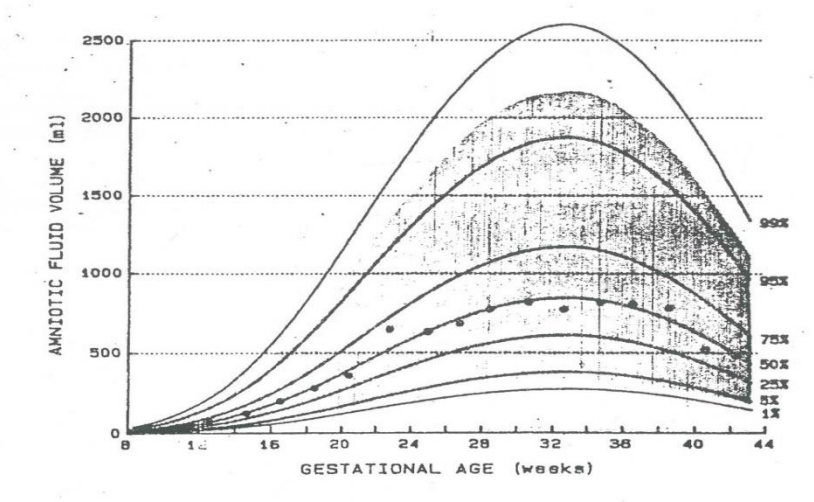
1. The amniotic fluid volume progressively increases during gestation until approximately 32 weeks.

2. From 32-39 weeks, the mean amniotic fluid volume is relatively constant in the range of 700-800 ml.

3. From 40-44 weeks there is progressive decrease in the AFV at a rate of 8% per week averaging only 400ml at 42 weeks.

4. The variation in "normal" fluid volume below the mean value is modest in the 3rd trimester. Oligohydramnios is present when AFV is approximately 300ml.However the variation in the upper range is almost 3 times greater with hydramnios (>95%) varying from 1700 ml 1900ml.

Fig No 4: NORMOGRAM SHOWING AMNIOTIC FLUID VOLUME AS A FRACTION OF GESTATIONAL AGE.



Other facts observed were:

- There is wide range for normal AFV in individual point, particularly in the middle of the third trimester when AFV reaches normal.
- The rate of volume change increased in absolute terms to a maximum of 60ml/week at 21 weeks. If expressed relatives to the total volume.
- The change in volume slowed from an increase of 45% per week at 8 weeks to just 10% per week at 24 weeks.

AMNIOTIC FLUID VOLUME ASSESSMENT

The optimal technique for assessing amniotic fluid volume should reproducibly estimate amniotic fluid volume and it should correlate well with abnormal fetal and maternal states.

To be an acceptable amniotic fluid volume assessment technique, it should:

1. Be derived from a population of healthy pregnant women.
2. Provide an accurate estimate of actual amniotic fluid volume with well-defined confidence limit.
3. Provide gestational age specific norms.
4. Define "abnormal" categories with excellent sensitivity and positive predictive value.
5. Be reproducible to permit comparison of observations from patient to patient from examining and longitudinally during gestation.

Various methods of AFV estimation:

1. Clinical
2. Semiquantitative assessment-Ultrasound
3. Quantitative.

CLINICAL:

Clinical method depends on palpation and measurements of the maternal abdomen. The diagnosis of increased fluid volume can be suspected by finding a uterine size larger than expected for the gestational age, easy external ballottement of the fetus, difficulty in defining fetal parts and muffled fetal heart sounds. An uterine size lesser than that expected for the gestational age and if the uterus feels full of fetus gives a hint for diagnosing oligohydramnios .However, it is poorly predictive of true amniotic fluid volume even by experienced people due to inter observer variation.

SONOGRAPHIC METHODS:

As the ability to visualize the fetus and its environment with ultrasound developed, several ultrasonographic methods of amniotic fluid volume assessment have been developed. These include:

1. Subjective assessment.
2. Single-deepest -pocket measurement.
3. Four-quadrant amniotic fluid index.
4. Planimetric measurement of total intrauterine volume.
5. Mathematical formulae for volume calculation.
6. Two – diameter pocket

Subjective Assessment:

It is accomplished by real - time scanning through the entire uterus and observing the amount of fluid in the gestational sac surrounding the fetus. The radiologist determines the relative amount of echo free fluid in the amniotic cavity as compares it with the space occupied by the fetus and the placenta and then categorized the volume as normal, decreased or increased.

Single Deepest Pocket Measurement:

This technique was developed from studies of Chamberlain et al.[3] This involves selecting the single deepest uninterrupted pocket of amniotic fluid and measuring its depth. It is also called as maximum vertical pocket. A measurement below 2 cm is considered to represent oligohydramnios and one above 8 cm represent polyhydramnios. This technique is reasonably reproducible and has the reasonable predictive power of poor pregnancy outcome.

Fig No 5: Amniotic fluid assessment using maximal vertical pocket

AFV	Maximum vertical pocket (cm)
Increased	**≥ 8**
Normal	**2 – 8**
Marginal	**1 – 2**
Decreased	**≤ 1**

Though the occurrence of MVP measuring less than 1 cm is extremely rare as noted by Bottoms et al, if present it is associated with increased perinatal morbidity.[36,37]

Four-quadrant amniotic fluid index:

This was first described by Phelan.[1] The amniotic fluid index is determined by dividing uterus into four quadrants by sagittal and transverse lines through the umbilicus and summing the vertical dimension of the deepest pocket in each quadrant. When the sum is below 8 cm is borderline reduced and when below 5 cm it is oligohydramnios and one above 20 cm is polyhydramnios.

Planimetric measurement of fetal intrauterine volume:

Total intrauterine volume is estimated by obtaining multiple scans at regular intervals. The intrauterine area is determined on each scan and multiplied by the duration of the interval. These values are summed to yield the total intrauterine volume.

Mathematical formula for volume calculation:

A variety of formulae using sonographic measurements have been proposed to calculate the amniotic fluid volume .However all these approaches make the assumption that the uterus (or fetus, placenta or deepest pocket) confirm to a regular shape, such as an ellipsoid.

Two diameter pocket:

This was described by Magann in 1992.[38] This technique is variation on the vertical pocket assessment of AFV. The two – diameter technique consists of identifying the deepest amniotic fluid pocket by measuring its vertical and horizontal dimension and then multiplying these values together. A value of 0-15 cm^2 represent oligohydramnios, 15.1 – 50 cm^2 represents normal and value of 75 cm^2 represents polyhydramnios.

QUANTITATIVE ASSESSMENTS:

1. Collecting amniotic fluid at hysterotomy or pregnancy termination.

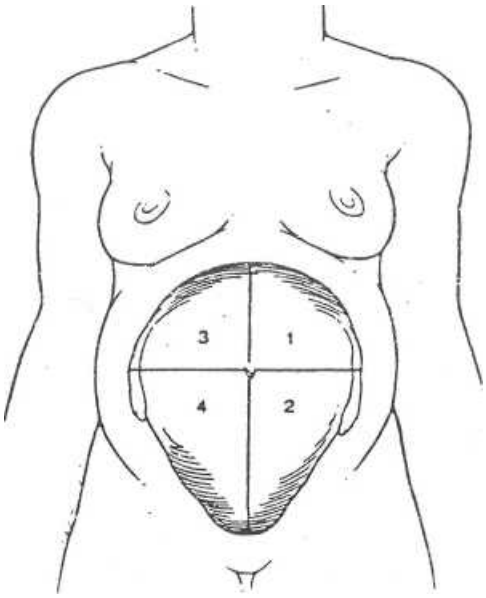
2. Indicator dilution technique: A known quantity of a measurement substance, the indicator, is instilled into the amniotic cavity. The concentration of the indicator in a withdrawn sample is inversely proportional to the volume of amniotic fluid. The use of dilution principle to determine AFV was developed over period of decades.Charles et al standardized the indicator dilution technique for AFV assessment. They used PAH (Para amino hippurate) which is inert, evenly distributes within the amniotic compartment and does not cross the placental barrier or amniotic epithelium. Thompson and colleagues later refined the PAH dilution technique by using a more simple and rapid spectrophotometric method for measuring the concentration of indicator in the withdrawn sample.

AMNIOTIC FLUID INDEX

In 1987 Phelan and co workers[1] described a semi quantitative measure that broadened the criterion for AFV assessment. This calculated value was termed the Amniotic Fluid Index. The amniotic fluid index is the sum of sonographic measurement taken from dividing the maternal abdomen into four quadrants.

Phelan believed that the MVP did not facilitate assessment of AFV in the entirely of the uterine cavity and did not permit clinicians to chart changes in AFV throughout pregnancy. The original work was conducted on 197 patients with various indications for using sonographic examination from 11 - 43 weeks. Phelan used 262 AFI values to describe the changes in AFV between normal 11 and 43 weeks. The shape of the graph of AFI to gestational age was similar to the shape of the graph of AFV to gestational age in the report by Brace and wolf i.e. AFI correlates with AFV changes in the gestation. Phelan modified the AFI for use in patients at less than 20 weeks of gestation. When the gravid uterus is at or below the umbilicus, the AFI is limited to the sum of larger pocket on right and left sides of the linea nigra.

Fig No 6: DIAGRAM SHOWING DIVISION OF UTERUS INTO 4 SEGMENTS FOR CALCULATING AFI



Technique of performing AFI:

Uterus is divided into 4 quadrants using the maternal sagittal midline vertically and an arbitrary transverse line approximately halfway between the symphysis pubis and the upper edge of the uterine fundus. If the uterus is < 28 weeks it should be divided into half. The transducer must be kept parallel to the maternal sagittal plane and perpendicular to the maternal coronal plane throughout. Tilting the transducer medially to curvature of uterus may result in inadvertent measurement of adjoining quadrant. The deepest 'unobstructed' and clear pocket of amniotic fluid is visualized and frozen. The ultrasound calipers are manipulated to measure a pocket in a strictly vertical direction. The process is repeated in each of the 4 quadrants and the pocket measurement is summed up to get AFI.

If the AFI is less than 8 cm the 4 quadrant valuation is to be repeated 3 times and the values averaged.

NOTE: Some authorities permit measuring through the umbilical cord or fetal small

parts while selecting amniotic fluid pocket.

Fig No 7: AMNIOTIC FLUID INDICES AS DESCRIBED BY PHELAN ET AL.

AFV	AFI (cm)
Oligohydramnios	**≤ 5**
Borderline	**5.1 – 8**
Normal	**8.1 – 20**
Polyhydramnios	**≥ 20**

Moore and Cayle assessed intraobserver and interobserver variations of 5 mm and 10 mm respectively in their study. It was concluded that adherence to guidelines of four quadrant technique of amniotic fluid index helps to minimize the observational variability.[39]

A study by Dildy et al. using paraamino hippurate showed that the AFI was highly predictive of actual volume with a correlation coefficient of 0.84 and mean error of 7%.[40]

REPRODUCIBILITY OF AFI

Bruner and coworkers have noted that when serial assessments of AFI are necessary, best accuracy can be obtained by repeated examination by a single observer. The factors which could adversely affect AFI reproducibility are: Measuring very narrow pockets, measuring inter gray or fuzzy tangential section of placenta / fetal part, measuring the same pocket twice in adjacent quadrants.[41]

Effect of fetal movements on AFI

Wax et al found that the mean change of AFI after fetal movements was 1.5±0.1 cm for post movement determination by same examiner due to shifting of amniotic fluid between the quadrants.[42]

Effect of fetal presentation on AFI

A study found an increase in the amniotic fluid index following successful external cephalic version in breech presentation from mean of 12.06 ± 3.15 to 15.19 ±3.35 cm.

Hence the presentation of fetus should be considered in the evaluation of AFI.[43]

Effect of transducer pressure on AFI

In a study by Flack N.J. et al (1994), the pressure of transducer on abdomen resulted in alteration in the AFI. Low pressure resulted in 13% increase and high pressure 20% decrease in AFI compared to medium pressure.[44]

Amniotic fluid indices in twin pregnancies

Individual amniotic fluid induces can be obtained in twin pregnancies and the values are comparable with those in singleton pregnancies. Although the twin pregnancies have slightly lower median amniotic fluid volume than singleton pregnancies, the differences is not statistically significant. [45]

Indications for & Frequency of Amniotic Fluid Volume measurement:-[46]

Given the convenience and reproducibility of the AFI, its use in fetal well-being assessments has expanded remarkably. Suggested indications for AFV evaluation are summarized as follows:

1. During the routine or targeted ultrasound examination after 16 weeks:

The precise AFI value and associated gestational age offer valuable clues to existing disease (congenital anomalies) and provides a precise reference point against which future values can be compared, particularly should pregnancy complication arise.

2. During antepartum testing:

Several recent studies have emphasized the value of including the AFI when performing non stress testing in at-risk pregnancies, in fact the two together constitute what is known as modified bio-physical profile as proposed by Vintzelos et al. The frequency at which AFI evaluations should be repeated during antepartum testing is not established. Ideally the choice of testing frequency will be based on the data regarding the rate of decrease in AFI during pathologic pregnancy status. Marks and Divon [47] reported the change in AFI during the post term period averaged 25% per week. Lagrew and associates [48] studied the change in AFI with time during twice-weekly antepartum testing, patients with normal

AFI (> 8cm) had 0.54 percent chance of oligohydramnios developing in the next 4 days. Whereas those with low normal AFI (5-8 cm) had a 5% chance of developing oligohydramnios in the next 4 days. These results suggest that AFI can be repeated weekly if the value is greater than the 10th percentile but should be evaluated more frequently if the value is in marginal range.

3. Monitoring patients with PPROM :

Serial evaluation of amniotic fluid volume may provide important prognostic information in patients with ruptured membrane before term, who are at increased risk for fetal distress, amnionitis and pre-term labour. Evaluation of AFV on admission with PPROM and then weekly in conjunction with periodic assessment of fetal heart rate tracing provides useful prognostic information about the risk for amnionitis impending labour and the likelihood of intrapartum umbilical cord compression.

Fig No 8: AMNIOTIC FLUID INDEX VALUES (MM) FOR NORMAL PREGNANCY AFI PERCENTILE VALUES.

Week	2.5^{th}	5^{th}	50^{th}	90^{th}	97.5^{th}
16	73	79	121	181	201
17	77	83	127	194	211
18	80	87	133	202	220
19	83	90	137	207	225
20	86	93	141	212	230
21	88	95	143	214	233
22	89	97	144	216	235
23	90	98	146	218	237
24	90	98	147	219	238
25	89	97	147	221	240
26	89	97	147	223	242
27	85	95	146	226	245
28	86	94	146	228	249
29	84	92	145	231	254
30	82	90	145	234	258
31	79	88	145	238	263
32	77	86	144	242	269
33	74	83	143	245	274
34	72	81	142	248	278
35	70	79	140	249	279
36	68	77	138	249	279
37	66	75	135	244	275
38	65	73	132	239	269
39	64	79	127	226	255
40	63	71	123	214	240
41	63	70	116	194	216
42	63	69	110	175	192

Reliability: Inter and Intra observer examination:

Reproducibility is a desirable characteristic of an amniotic fluid estimation.This was observed by Moore and coworkers.[49] They noted mean errors of 5.0 mm & 10 mm, equivalent to 3% and 7% of AFI in form of intra and inter-observer variation. However, although the absolute error was fairly constant regardless of AFI measured, percentage error increased to 10-15% when the AFI was less than 10 cm i.e, wider variation is present in AFI values denoting oligohydramnios.

A study reported the co-efficient of variation in AFI measurement to be 10.8% (within examiner) &15.4 %(between examinations).Another study found an intra-observer error of 1cm, inter-observer error of 2 cm.[50]

These difference in measurement could be due to:

a) Fetal movements.
b) Fetal swallowing following acoustic stimulation
c) Emptying of fetal bladder, which was over distended during the previous measurements.
d) Pressure on the transducer with high pressure AFI decreases.

Correlation of AFI with true amniotic volumes

Several studies have addressed the relationship between the AFI and actual amniotic fluid volume.

- Strong and associates correlated an intravenous infusion of 250 ml of saline with an increase in AFI of 4 cm.[51]
- An Indian study reported a mean increase in AFI of 5.8 +/- 2.6 cm after a similar volume of saline infusion.[16]

The above two results suggest that an AFI of 14 cm at term would be equivalent to an AFV of 700 ml. This estimation is congruent with the reports of AFV determined at term by direct collection or indicator dilution. Therefore showing that AFI is a good indicator of the actual amount of amniotic fluid present within the uterine cavity at any given gestation.

Magann and colleagues used PAH indicator dilution technique and to calculate AFV in 40 third trimester pregnanciesand compare it with sosographic methods. "Normal" amniotic fluid volume was correctly predicted by AFI in 50 %, by MVP in 50 % and 2 diameter method in 61 %. In detecting oligohydramnios AFI was 65 % efficient, MVP was |63 % and 2 diameter method was 75 %. They concluded that the correspondence between ultrasonographic volume predictions and actual volume was moderately accurate.

In summary these studies found that the AFI as a estimation tool was reproducible and proportional index of actual amniotic fluid volume. It is probably more reliable in identifying extremes of amniotic fluid volume than MVP. However no ultrasound method has accuracy consistently less than +/- 25%. This is probably due to derivation of a three-dimensional parameter such as volume from data contained from two dimensional image.

CRITIQUE OF THE AVAILABLE METHODS

Clinical methods give us a hint of abnormal AFV. But it has its own restriction which makes accurate prediction difficult.

Sonographic method: Diagnostic ultrasound offers a window into the intrauterine environment & permits direct measurement of amniotic fluid volume. There are various methods. However, no single method has emerged most predictive.

Subjective:

This method is the most frequently used technique today. It is simple and rapid. It requires an observer and lacks numerical result for comparison and trending- important disadvantages. Moreover there is reproducibility problem. Halperin et al studied the findings of sonographers subjective assessment of AFV. Sonographer visually estimated AFV in 33 randomly selected sonograms. They found intraobserver correlation scores were dependant on the experience of sonographers. There was a significantly higher intra observer correlation scores in experienced sonographers than those with less experiences.[52] Despite these reproducibility problems, Moore & associates found that well trained observers can reliably assign patients with oligohydramnios to a subjective scale within intra class correlation coefficient of 0.81.[49]

Although subjective methods are convenient and simple, experienced sonographers are necessary for reliable results.

Maximum vertical pocket:

The technique of measuring MVP to represent AFV was just described by Manning and Platt as a part of the biophysical profile in 1980. They proposed "1cm rule" and found sensitivity of 89% detecting IUGR.[53]

In 1984 Chamberlan determined the MVP in 7562 high-risk pregnancies undergoing ultrasound examination in the third trimester. They gave the criteria for normal values.

Amniotic fluid Volume	% of patients	MVP
Increased	3	**>/=8**
Normal	94	**>2-<8**
Marginal	2	**>/= 1 - </=2**
Decreased	1	**< 1**

The disadvantages of this scale and study are:

1. It was derived from high risk patients rather than from healthy pregnant women.
2. Patients were studied in the III trimester rather than at various gestational ages.
3. The interobserver and intraobserver variation in MVP measurements was not evaluated.
4. The relationship of the MVP to the actual AFV was determined.

In 1974 Bottoms and associates evaluated the ability of the MVP to detect abnormal fetal growth in 487 pregnant between 26 and 43 weeks gestation. They found that absence of a fluid pocket at least 1cm deep was exceedingly rare and may be too restrictive criterion for oligohydramnios.

Goldstein and Filly compared the MVP to subjective evaluation. They found MVP technique was no better than the volume assessment rendered by subjective methods by experienced sonographers.[54]

In summary MVP method is simple and straightforward but has little mathematical validity or rationale. The volume of a simple shape such as sphere or cube is directly

related and can be calculated from a single measurement. In contrast the volume of a highly irregular shape such as the uterus and amniotic cavity cannot be calculated from one measurement. In addition, the single deepest pocket measurement can vary considerably if the fetus changes its position. Furthermore, measurement of a deep but thin "pancake" shaped collection between the fetal lungs or alongside the fetus may yield a normal value even in the presence of severe oligohydramnios.

Amniotic fluid index Vs maximum vertical pocket:

The relative efficiency of AFI and MVP technique to predict oligohydramnios and polyhydramnios was compared by Moore.[55] AFI was used as a gold standard against which MVP criteria of oligohydramnios and hydramnios were correlated with correlation co-efficient of 0.51. However the ability of MVP technique to identify oliogohydramnios was poor. 58% of case of oligohydramnios by AFI had normal values according to the single – pocket technique. The sensitivity and specificity in detecting polyhydramnios were 42% and 51% respectively.

Rutherford reported comparable to superior results with the use of the AFI Vs single pocket technique without significant interobserver or intraobserve difference among sonographer.It was concluded by above studies that although the MVP demonstrates adequate specificity for abnormal values, it is insufficiently sensitive for sonographic screening of AFV.

Planimetric measurement of total intra uterine volume:

This approach is slow and cumbersome some requiring tracing of the uterus on each scan to complete the area. An articulated arm is required to ensure that proper scan planes are obtained. The result of this time consuming calculation is not the amniotic fluid volume itself, but rather the sum of amniotic fluid fetal and placental volumes.

Mathematical formulae for volume calculations:

In all such formulae assumption is made that the uterus (or fetus, placenta or deepest pocket) is of a regular shape,such as ellipsoid. Such assumptions are oversimplifications that can lead to inaccuracy.

Two diameter pocket:

In 1992 Magann conducted a study that described this technique. 40-third trimester pregnancies were studied using this technique. These patients were undergoing amniocentesis for determination of fetal lung maturity. Comparison with AFV quantified

by PAH dilution was done. It was found that 2-diameter pocket correctly identified normal fluid volumes in 61% of pregnancies, hydramnios in 67% of pregnant and oligohydramnios in 75% of pregnancies. It was concluded that this technique is an acceptable alternative to MVP and AFI.

Quantitative Assessment:

1. Direct quantification of AFV: Performed at hysterotomy / pregnancy termination has no role in clinical practice because it cannot yield antenatal information to stratify pregnancy risk. It is also not practical for clinical research because only one measurement of fluid volume can be determined.
2. Indicator – dilution technique: This technique offers quantitative accuracy. But carries inherent risk of infection, induction of labour, rupture of membrane and fetal injury. They are time consuming, expensive and not readily available. Invasive methods are favoured investigational tool for research, but these techniques are not acceptable by patients for routine or repeat measurement of AFV.

Why AFI is favoured?

1. It assesses the total amount of fluid within the intra amniotic cavity and not just a single pocket.
2. The curve of AFI against gestational age is remarkably similar to that generated from dye – dilution or direct measurement studies.
3. The technique has been standardized to reduce the inter-observer variation between examiner and institutions.
4. It provides a measurement of amniotic fluid that can be followed on subsequent examinations.
5. It is more sensitive than a single vertical pocket measurement.

OLIGOHYDRAMNIOS

An amniotic fluid volume less than the two standard deviation below the mean for specific gestational age

or

Amniotic volume reduced below the 5th percentile for particular gestational age is defined as oligohydramnios.

Based on this definition volume less than 300 ml at term would constitute oligohydramnios. In some instances the amniotic fluid may be reduced to only few ml or viscid fluid.

Various authors have used different cut off values for diagnosis of oligohydramnios.

However in recent years AFI is used by most of the authors. Between 36-42 weeks Phelan et al defined oligohydramnios as AFI less than or equal to 5 cm and borderline oligohydramnios as AFI between 5 and 8 cm.

Incidence:

Oligohydramnios affects approximately 3.9% of all pregnancies. According to Phelan, the likelihood of a low AFI (</= 5 cm) between 36-40 weeks gestation was 2.4% .Mark and Divon found oligohydramnios in 12% of 511 pregnancies at 41 weeks or later.

Etiology and Diagnosis

Both from etiological stand point and prognostic implications there are two basic types of oligohydramnios, which depends on the time of onset.

1. Early onset
2. Late onset

Conditions which are commonly associated with oligohydramnios

Early onset	Late onset
• Chromosomal abnormalities Congenital anomalies Ruptured membranes • Fetal demise • Following amniocentesis or chorionic villous sampling • Twin to twin transfusion Prostaglandin synthetase inhibitors • Angiotensinogen converting enzyme inhibitors	• Placental insufficiency • Hypertension a. Preeclampsia b. Diabetes • Hypovolemia Abruption • Ruptured membranes.

Ruptured Membranes

It is the most common cause of oligohydramnios. The diagnosis is usually straight forward when a typical history of leaking PV can be elicited and leaking liquor is demonstrable on speculum examination. In many instances, the diagnosis is difficult especially in occult PROM. Transabdominal amnioinfusion using ringer lactate with indigo carmine and subsequent demonstration of leaking fluid confirms the diagnosis.

Fetal Malformations

Fetal abnormalities particularly involving the urinary tract are an important cause of early onset oligohydramnios. The incidence of structural abnormalities and aneuploidy ranges between 7-37%.

Various fetal abnormalities associated with Oligohydramnios are**:**

Genitourinary: (33-57%)

- Renal agenesis
- Urethral obstruction
- Bladder exostrophy
- Prune belly syndrome
- B/L multicystic
- dyplastic kidney
- Meckel-Gruber syndrome
- Pelviureteric junciton obstruciton

Non renal

1. Cardiac :
   Congenital heart block
   Fallots tetralogy
   Septal defects
2. Hypothyroidism.
3. Skeletal :
   Sirenomelia
   Sacral agenesis
   Absent radius
   Facial clefting
4. CNS :Holoprosencephaly, meningocoele ,Encephalocoele, microcephaly
5. Cloacal dysgenesis
6. Cystic hygroma
7. Diaphragmatic hernia
8. TRAP (Twin reverse arterial perfusion) sequence.
9. VACTERL (Vertebral, anal, cardiac, t r a c h e o esophageal, renal, limb) association.

Intra uterine fetal growth retardation:

One of the signs of severe fetal malnutrition is decreased amniotic fluid volume. This usually happens in maternal diseases such as chronic hypertension, connective tissue disorder, severe pre eclampsia and chronic renal diseases.

'The basis for association of IUGR with oligohydramnios has been elicited in animal models. Experimental hypoxia result in redistribution of fetal cardiac output i.e. there is a decrease in renal blood flow and pulmonary blood flow. Hence, urinary output and the production of fluid by the lungs decrease and the amount of amniotic fluid declines. It has been shown that the hourly urinary output, which was 14 ml in the 28th week and 26.8 ml in the 40th week, reduces to 4.7 ml & 15.4 ml respectively in IUGR babies.

Leaking fluid following amniocentesis or CVS:

Leaking fluid is an uncommon complication affecting less than 1 % of patients undergoing amniocentesis or CVS. In almost all of these cases the leak will seal and fluid will re-accumulate.

Drugs

Prostaglandin synthetase inhibitors like indomethacin have been shown to reduce human fetal and neonatal urinary output. Fetal side effects of indomethacin is closure of ductus arteriosus and oligohydramnios. They have been used in treatment of preterm labour and symptomatic polyhydramnios. Angiotensinogen converting enzyme inhibitors if used in pregnancy can cause oligohydramnios.

Post-term pregnancy:

Amniotic fluid volume decreases after 40thweek and more rapidly after 42 week at a rate of 33%. The decrease in the amniotic fluid volume may be because of failing placental function and / or decreased fetal urine production. Diminished urine output is due to progressive maturation of renal function with gestation and increased sensitivity of tubules to vasopressin and increased tubular reabsorption.

The perinatal mortality increases dramatically with progressive severity of oligohydramnios. In addition, there are changes in amniotic fluid compositions also. The fluid becomes milky and cloudy because of abundant vernix caseosa. The phospholipid composition changes and L/S ratio becomes 4:1 or more and amniotic fluid may be meconium stained.

Second trimester oligohydramnios:

Cause for second trimester oligohydramnios are the same as for the third trimester and include fetal urinary tract anomalies rupture of membranes and placental insufficiency. Maternal serum alpha fetoprotein levels are frequently increased with 2nd trimester oligohydramnios. Cardiac malformations are also increasingly seen. If second trimester oligohydramnios results from a genetic amniocenteses or CVS fluid frequently reaccumulated and oligohydramnios may resolve. If 2nd trimester oligohydramnios persists the outcome is poor regardless of its cause.

Additional diagnostic procedure

Detailed sonographic assessment of the fetus is essential to arrive at diagnosis especially in early onset oligohydramnios. However, the absence of adequate amniotic fluid, and hyper flexed attitude of the fetus makes sonographic evaluation difficult. The following additional procedures have been used to improve diagnostic accuracy in these situations.

1. Diagnosis amnioinfusion
2. Dye amnioinfusion.
3. Fetal intraperitoneal infusion
4. Fetal furosemide challenge
5. Colour doppler

OLIGOHYDRAMNIOS SEQUELAE:

Lung hypoplasia: This is a feared sequelae of oligohydramnios affecting 60 % of fetuses with prolonged oligohydramnios. It is characterized by severe respiratory distress occurring immediately after birth and requiring maximum ventilatory support. The lungs are small and clear on x-ray examination. The course is characterized by the development of multiple pneumothorax and interstitial emphysema. The outcome is usually fatal, and survivors frequently suffer from chronic bronchopulmonary dysplasia.

In the past this was attributed to compression due to reduced liquor. Thoracic compression may prevent chest wall excursions and lung expansion. More recently, Nicolini et al hypothesized that lung hypoplasia is due to low amniotic fluid pressure.[56] The normal intra-amniotic pressure ranges between 1-14 mm Hg. However, with oligohydramnios and intact membranes the intra-amniotic pressure </= 1 mm Hg. There is an increase in intra-alveolar to amniotic fluid gradient resulting in a greater outflow of lung fluid. When there is a sufficient loss of intra-alveolar fluid, lung growth is impaired. This complication can be prevented by restoring intra amniotic pressure to normal by physiological saline.

The prenatal diagnosis of pulmonary hypoplasia is not accurate. A number of different sonographic measurements and rates have been suggested in an attempt to predict pulmonary hypoplasia. The best method is the measurement of the thoracic-to- abdominal circumference ratio. When it is 0.89 or greater, the prognosis is good.

Fetal deformities :

Fetal deformities associated with oligohydramnios are:

- Potter facies (prominent epicanthal folds flattened nose & low set ears)
- Abnormal positioning of the hands and feet
- Clubfoot and other skeletal deformities.
- Adhesion between amnion and fetal part may cause amputation.

Prognosis

1st Trimester:

Low fluid volume in the first trimester (as evidenced by small sac size) is a predictor of poor fetal outcome. In one study, 94% (15 out of 16) mothers of living fetus with small sac size in the first trimester went on to have spontaneous abortion.

2nd Trimester:

In general 2nd trimester oligohydramnios has a poor outcome. Shenkar and colleagues described 80 such pregnancies and only half of these fetuses survived.[57]

Mercer and Brown described 34 mid trimester pregnancies complicated by oligohydramnios, 9 (26%) had anomalies. 10 out of 25 who were phenotypically normal either aborted or were stillborn. Of the 14 born alive, eight were pre term and seven died. The six infants born at term did well.[58]

Oligohydramnios in late pregnancy (3rd trimester):

- Increased risk for adverse perinatal outcome
- Increased risk for operative deliveries
- Increased incidence of meconium staining of liquor, fetal distress.

Diagnosis:

Oligohydramnios is said to be present when AFV is < 400 ml after mid trimesters. Clinically oligohydramnios is suspected when;

- Uterine size is smaller for the gestational age
- Uterus feels full of fetus

➢ The diagnosis of oligohydramnios is confirmed by ultrasonography.

Subjective sonographical criteria

- Obvious lack of amniotic fluid
- A poor fluid- fetal interface
- A marked crowding of fetal parts & uterus moulded to the fetus
- Uterine contour round & firm as opposed to the usual oval & flexible.

Semi – quantitative methods

MVP: Manning et al defined oligohydramnios when MVP <1 cm

AFI : Phelan described oligohydramnios when AFI < 5 cm and AFI < 8 cm it was considered as borderline reduction

Two – diameter pocket: A two diameter pocket of < 15 cm^2

Evaluation

Evaluation of oligohydramnios include:

- Assessment for rupture of membranes
- Targeted ultrasound for fetal anomalies
- Ultrasound to assess for intra uterine growth restriction
- Amniocentesis for intra uterine growth restriction
- Amniocentesis for chromosome analysis
- Maternal antinuclear antibody,anti cxardiolipin antibody and lupus anticoagulant
- Kleihauer – Betke count

MANAGEMENT

Second trimester oligohydramnios

There is a significant risk for pulmonary hypoplasia, which is an almost uniformly lethal neonatal condition in second trimester oligohydramnios. And this is a compelling reason to search for treatment.

Several treatments have been tried in mid trimester oligohydramnios to maintain amniotic fluid volume & thus promote lung development. These include

- Vesico amniotic shunting in obstructive uropathies
- Infusion of fluid via a trans cervical catheter
- Cervical canal occlusion with fibrin gel
- Maternal hydration
- Serial transabdominal therapeutic amnioinfusions.

Third trimester oligohydramnios

All pregnancy patients with oligohydramnios should be advised to discontinue tobacco use, moderate their activity level and maximize their health status with regard to cardio pulmonary issues. A review of maternal co morbidity and medication use should be conducted when the etiology remains unclear. An assessment of fetal viability is an integral component of the initial evaluation with a viable pregnancy, fetal monitoring with NST or a BPP should be performed. If fetal testing is abnormal, delivery is recommended. If fetal testing is normal, corticosteroids to assist lung maturation should be administered upto 34 weeks. Because of the increased risk for cord accident, delivery should be considered when complications associated with weight and gestational age can be accommodated by intensive care nursery.

Amnioinfusion:

Amnioinfusion has been done in oligohydramnios in the following condition:

- Meconium stained amniotic fluid
- Variable decelerations

(The above two occurring during labour)

- Prophylactically for oligohydramnios

Prophylactic amnioinfusion:

There have been several randomized controlled trials evaluating whether prophylactic amnio infusion in patients with oligohydramnios improved the neonatal and maternal outcome.

In one study, patients who had prophylactic amnioinfusion at the time of induction of labour, it was noted that there was a significant decrease in the incidence of variable decelerations in those patients with amnioinfusion compared with the control group. However there were no significant differences in neonatal outcome, route of delivery or amnionitis.[59]

Scheimer et al reported a significant decrease in caesarean rate with 14% in the

infusion group and 28% in control group and also a significant decrease in ceasearean section for fetal distress.[60]

However, similar studies by Chauhan et al and Ogundipe OA et al showed no improvement in neonatal and maternal outcome.[61,62]

Amnioinfusion for fetal variable decelerations:

It was Gabbe who noted that removal of amniotic fluid results in variable deceleration. These decelerations are due to cord compression and there is little doubt that amnioinfusion is associated with relief of fetal variables deceleration. However, whether this intervention results in improved maternal and /or neonatal outcome is not clear.

Miyazaki et al and Owen et al had a significant decrease in variables decelerations but no significant decrease in caesarean section rate or a significant difference in neonatal outcomes.[63,64]

Presumably amnioinfusion is associated with less cord compression and thereby reducing variable decelerations. But variable deceleration alone is rarely associated with poor neonatal outcome. Hence it is not unexpected that relief of variable deceleration is not associated with better neonatal outcome. However, given the low morbidity associated with amnioinfusion, particularly in multi parous women, it seems reasonable to proceed with amnioinfusion in a woman with repetitive, moderate or severe variables deceleration, if the alternative being considered as a caesarean section.

Amnioinfusion for meconium stained AF:

Amnioinfusion for these cases complicated by oligohydramnios was assessed and showed reduced incidence of meconium aspiration syndrome.

Amnioinfusion:

Amnioinfusion can be done transabdominally or transvaginally.

Transabdominal: This procedure is done under ultrasound guidance. The needle should be advanced slowly with USG visualization and when the tip of the needle reaches the interface between the fetus and the membranes, a warmed saline solution should be infused. In majority of cases, 250 ml-350 ml of saline solution will be necessary to achieve optimal ultrasound transmission. A normal fetus will swallow the

infused fluid and its bladder will be seen an ultrasound after approximately 20min. The bladder will not be seen in renal agenesis, before terminating the procedure 1 ml of indigo carmine is injected and patient is asked to wear a tampoon. This helps to detect PROM.

Trans-vaginal amnioinfusion:

Normal saline is infused via an intra-uterine pressure catheter into the uterus either by gravity or using an infusion pump. Most commonly an initial bolus of 600ml or 10 -20 ml /min for the first hour was used, followed by a maintenance rate of 3 ml/min. the maintenance rate was continued until delivery or until variable deceleration ceases. Alternatively a bolus of 250-600 ml is given in the first 30- 60min and then the infusion is stopped if an AFI> 5 cm is reached. Repeated boluses of 250 ml are given if the AFI had not reached the set goal.

Risk and complications amnioinfusion:

1. Infection : maternal / neonatal

However majority of investigations have found that there is no increased risk for infection.

2. Amniotic fluid embolism:

3. Increased uterus tone:

Since infusion is done with intra uterine pressure catheter the measured tone showed that there is an increase in tone. But no cases of uterine rupture have been reported.

In general, amnioinfusion has been associated with minimal if any quantifiable risk.

Maternal hydration

Experiments on Ewe have shown that maternal dehydration (either by water deprivation or IV mannitol) causes reduction in the fetal urine flow rate, free water clearance and a 35% reduction in AFV. Direct fetal intra vascular infusion also increases fetal urine output and AFV. By giving Ewes oral water loading (2000ml) and IV arginine maternal osmolality was decreased likewise fetal osmolality was significantly decreased too. Fetal urine flow rare and AFV significantly

increased. These findings strongly suggest that maternal osmolality affects fetal osmolality and consequently fetal urine output and amniotic fluid volume. Thus it is clear that AFV can be altered by maternal hydration state.

Kilpatrick et al found oral maternal hydration with 2 L of water was associated with an increase in the AFI by approximately 30% in women with decreased AFI.[65]

Although changes in AFI in women with oligohydramnios are numerically small, they may be clinically significant. An increase of 30% in AFI in a patient with oligohydramnios may place her fluid volume (at least temporarily) in the normal range, which would potentially allow continuation of her pregnancy. Whether this is effective and safe way to manage is still unknown and may be related to the cause of oligohydramnios.

Example: in conditions with severe IUGR with chronic oligohydramnios this prescription would be insufficient to alter AFV. In contrast, a fetus with a more acute cause for decreased AFV may, if adequate placental perfusion exists, respond to maternal fluid therapy.

Fetal furosemide:

Effects of fetal furosemide has been studied in sheep. The IV fetal furosemide was associated with a significant increase in fetal urine flow rate and an increase in AFI. In addition, intra amniotically placed furosemide was associated with a significant increase in fetal urine output suggesting that furosemide can work by direct absorption through the intra membranous pathway. There is probably little ethical role for this drug as prescription in oligohydramnios because of its concomitant effect on maternal volume status.

Water immersion:

Strong H. has reported a five cases of women with oligohydramnios treated with subtotal immersion into a pool of water. They were immersed into 24 inches of 34^0 C water once or twice daily for a period of 30min. All women showed a significant increase in AFI.This treatment was based on the assumption that increased uteroplacental blood flow is needed to increase AFV, and that water immersion decreases peripheral oedema by hydrostatic pressure.

Oligohydramnios in postdated pregnancy:

There are quantitative and qualitative changes in amniotic fluid with prolonged pregnancy. Decreased placental perfusion and diminished fetal urine production could be the reason. During fetal surveillance if oligohydramnios is detected it indicates the need for delivery. The patient must be admitted to the hospital for induction of labour. An intra-uterine pressure catheter should be placed as soon as feasible. Amnioinfusion with 1000 ml normal saline may be performed. It will prevent cord compression and fetal distress.

ISOLATED OLIGOHYDRAMNIOS

Isolated oligohydramnios (IO) refers to the presence of oligohydramnios without fetal structural and chromosomal abnormalities, without fetal growth restriction, without intrauterine infection, and in the absence of known maternal disease. The incidence of IO ranges from 0.5 to 5% depending on the definition used and the population studied. When IO is diagnosed at term (>37 complete weeks of gestation), it is commonly considered a solid indication for labor induction. There are contradicting evidence that isolated oligohydramnios is associated with adverse perinatal outcomes such as increased incidence of caesarean section and labour induction and adverse perinatal outcomes such as lower birth weight and decreased Apgar at 1 and 5 mins .Hence this type of oligohydramnios needs to be investigated further .

Summary:

Once oligohydramnios is detected a careful assessment of mother and fetus is necessary. With the treatment of the primary disease process (i.e. hydration of hypovolemic patient, the placement of a bladder amniotic shunt in a fetus with posterior urethral valves etc,) the AFV can return to normal. If maternal or fetal therapy is not available appropriate parental counselling concerning the fetal risks of oligohydramnios will help the couple select an appropriate plan of management.

At term if any signs of fetal compromise are present delivery should be considered. Presence of maternal disorders which cause uteroplacental insufficiency like hypertension and diabetes also necessitates delivery. The management of isolated term oligohydramnios is controversial. Some authors prefer to induce labour because development of oligohydramnios represents chronic fetal hypoxia. However few studies show that perinatal morbidity and mortality is not altered by inductions in otherwise normal pregnancy. Most of the morbidity occurs during intrapartum period and careful intrapartum surveillance is a must.

FETAL SURVEILLANCE

Since the estimation of amniotic fluid volume is used in fetal surveillance and is an important parameter in BPP scoring system it is necessary to discuss briefly about other surveillance tests.

Number of tests have been described for antepartum fetal surveillance. No single testing modality should be regarded as exclusive choice for fetal surveillance as these tests reveal different aspects of fetal pathophysiology often in a complimentary manner. Obviously further work is needed to determine the optimal integration of the various surveillance methods for improving the perinatal outcome in a cost effective manner.

Fetal movement assessment

Monitoring fetal movements serves as an indirect measure of CNS integrity and functions. Various methods which have been used to quantify fetal movements and to prognosticate fetal wellbeing are maternal subjective perception, tocodynamometer, realtime ultrasound, doppler ultrasound.

Maternal subjective perception

Charting of mothers perception of fetal movements is the oldest and simplest method to monitor fetal well-being. Studies have shown a significant correlation between number of movements perceived and those confirmed by ultrasound. For eg: Rayburn found that 80% of all movements seen during ultrasound monitoring were perceived by mother.[66]

Daily fetal movement charting is a worthwhile adjunct to antepartum fetal surveillance and helps in determining the frequency of surveillance tests, in predicting abnormal FHR pattern and perhaps impending stillbirths.

NST – non stress test

NST is the most widely used primary method for assessment of fetal well-being and has also been incorporated into the BPP scoring system. It describes the FHR accelerations in response to fetal movements, as a sign of fetal health based on the hypothesis that heart rate of the fetus who is non-acidotic will temporarily accelerate in response to fetal movements.

NST classification

Normal pattern is defined as reassuring NST which requires minimum of two accelerations of atleast 15 bpm from base line to the peak, lasting for atleast 15 seconds from the beginning of the rise to return in conjunction with fetal movements during a 20min period. However ACOG (2009) has recommended that accelerations without fetal movements should also be accepted. Failure to qualify into non-reassuring pattern in two consecutive 20min period is deemed as non-reassuring. Loss of such reactivity is most commonly associated with sleep cycle. Extension of test to 80-120 min reduces the incidence of non-reassuring NST by 50%.[67](fig no 9)

Three-Tiered Fetal Heart Rate Interpretation System

Category I

- Category I FHR tracings include all of the following:
- Baseline rate: 110–160 beats per minute
- Baseline FHR variability: moderate
- Late or variable decelerations: absent
- Early decelerations: present or absent
- Accelerations: present or absent

Category II

Category II FHR tracings includes all FHR tracings not categorized as Category I or Category III. Category II tracings may represent an appreciable fraction of those encountered in clinical care. Examples of Category II FHR tracings include any of the following:

Baseline rate

- Bradycardia not accompanied by absent baseline variability
- Tachycardia

Baseline FHR variability

- Minimal baseline variability
- Absent baseline variability with no recurrent decelerations
- Marked baseline variability

Accelerations

- Absence of induced accelerations after fetal stimulation

Periodic or episodic decelerations

- Recurrent variable decelerations accompanied by minimal or moderate baseline variability
- Prolonged deceleration more than 2 minutes but less than10 minutes
- Recurrent late decelerations with moderate baseline variability
- Variable decelerations with other characteristics such as slow return to baseline, overshoots, or "shoulders"

Category III

Category III FHR tracings include either

- Absent baseline FHR variability and any of the following:
  - –Recurrent late decelerations
  - –Recurrent variable decelerations
  - –Bradycardia
- Sinusoidal pattern

Deceleration during NST

ACOG (2009) has concluded that variable deceleration during NST (if non repetitive and brief) is not a sign of fetal compromise. In contrast repetitive variable deccelerations have been associated with increased risk of caesarean delivery for fetal distress and the risk is even more if associated with AFI $\leq$5 cm. Apart from non- reassuring pattern, repetitive variable deccelerations, baseline oscillation of less than 5 bpm, late decelerations with spontaneous uterine contractions are also consistently associated with evidence of uteroplacental pathology.

Predictive value

A reassuring NST would be followed by fetal death within one week at rate of approximately 4-5 / 1000 tests and the incidence is more if oligohydramnios is present. It has been realized that reassuring NST does not give long term prognostic implications. A reassuring NST not only indicates fetus that is not stressed by hypoxia but also a fetus who has successfully adapted to chronic placental insufficiency. Therefore it is not guarantee against subsequent fetal death and hence the need for repeated NST. NST for adverse fetal outcome has high specificity of 90-95% but sensitivity is only about 50%. Inspite of these problems it is still used widely both as a diagnostic and screening test.

The CST- Contraction stress test

In this method stress is applied by eliciting uterine contraction which causes intermittent interruption of blood supply and uncovers the uteroplacental insufficiency by producing late decelerations and variable decelerations in presence of oligohydramnios.

Contractions are elicited either by oxytocin infusion (oxytocin challenge test) or by Nipple stimulation. Positive CST correlates with adverse perinatal outcome. It complements other methods because of its low false negative rates and its findings parallel the intrapartum methods. It is an acute indicator of oxygen and acid base status rather than a long term predictor of neurological outcome. The false positive rates for CST average 30%. Further, it's a cumbersome procedure, needs about 90 min and intravenous infusion and cannot be used in whom uterine activity is contraindicated. The

non-invasive methods like BPP are comparable with CST in terms of outcome and interventions.

Fetal acoustic stimulation test (FAST):

Smith and colleagues in a randomized controlled study showed that the non-reassuring NST reduced from 14% to 9% following FAST. All data support that FAST is as reliable as spontaneously reassuring NST. Further, it also reduces the testing time.

FAST has also been used in intrapartum fetal assessment when faced with abnormal FHR pattern in place of fetal scalp blood sampling or prior to it. In a study by Smith and colleagues 41% of fetuses with abnormal pattern responded with reassuring pattern post FAST and none of them were acidotic and 53% of those who did not respond were found to be acidotic.[68]

It has also been used in admission test and to get favourable positions on ultrasound examination. The available information suggest that FAST is clinically safe.

Biophysical profile

In 1980 Manning and colleagues proposed the use of biophysical variables on ultra sound for antepartum fetal surveillance

Variables		Score 2	Score 0
1	NST	≥ 2 accelerations of ≥ 15 bpm ≥ 15 sec in 20-40 min	**0 or 1 accelerations in 20-40 min**
2	Fetal breathing	≥ 1 episode of rhythmic breathing lasting ≥ 30 sec within 30 min	**< 30 sec of breathing in 30 min**
3	Fetal movements	≥ 3 discrete body or limb movements within 30 min	**≤ 2 movements in 30 min**
4	Fetal tone	≥ 1 episode of extension of fetal extremity with return to flexion or opening and closing of hand	**No movements, no flexion / extension**
5	**Amniotic Fluid volume**	**Single vertical pocket > 2 cm**	**Largest single vertical pocket < 2 cm**

For each variable a score of 0 or 2 is given. Among all variable amniotic fluid volume is the most important marker of chronic fetal distress. A score of 8 to 10

indicates good fetal health while score 4 or less measured 6 hours apart indicates need for delivery and is significantly associated with low umbilical venous blood pH. Manning and colleagues reported 1 death per 1000 during intrapartum period following normal test results. The perinatal mortality varies from nil when all variables are normal to 60% when all variables are abnormal. Further the perinatal morbidity rates increase progressively as the score decreases. Typically these tests required 30-60 minutes.

Modified biophysical profile

As the classical BPS system requires about 30-60 min only 2 parameters, the NST and amniotic fluid volume assessment was introduced which is called modified biophysical profile. Modified biophysical profile is a excellent method of antepartum fetal surveillance. Amniotic fluid index is measured instead of maximum vertical pocket measurement and less than 5 cm is considered abnormal. This test requires only 10 min. ACOG has concluded that MBPP is an acceptable means of antepartum fetal surveillance.

Visual Acoustic Stimulation Test

Visual acoustic stimulation test was developed by Dr. Damania from Bombay.It utilizes ultrasound to evaluate the fetal response to acoustic stimulation. Both acute and chronic markers of uteroplacental insufficiency are assessed. So in VAST evaluation is done regarding.[69]

I. Chronic responses - Fetal growth, amniotic fluid index
II. Sympathetic responses - Startle response, Accelerations
III. Behavioural state response - Breathing, movements

The observation time after visual acoustic stimulation is maximum of 10 min. VAST performs well as a test of fetal well-being with a sensitivity of 87.9%, specificity of 77.8%, positive predictive value of 86.4% and false negative rate of just 12%.

Doppler velocimetry

Umbilical artery velocimetry is most commonly used. A S/D ratio more than 95th percentile for gestational age, absent or reversed end diastolic flow signifies increased impedance and is associated with fetal growth restriction. Absent or reversed end diastolic flow and umbilical venous pulsations have a grave prognosis for fetus, as reported by Zelop and colleagues (1996) the PNM rate for reversed end diastolic flow is 33% and for absent diastolic flow is 10%.[70]

When fetal hypoxemia occurs, fetus switches on a compensatory mechanism and increases the blood flow to brain (Brain sparing effect). The ratio of middle cerebral arterial RI to umbilical arterial RI less than one is considered to be indicator or fetal compromise and early evidence of fatal growth restriction.

Computerized analysis of antepartum CTG

Dawes introduced software system to analyse the CTG recordings on line from a standard antenatal monitor. The usefulness of computerized analysis of CTG in screening and clinical management awaits larger studies.[71]

Admission test

A dynamic screening test for the state of oxygenation of the fetus right on admission of the mother in labour room, which would help one to choose the appropriate type of intrapartum surveillance in a given case and allow more rational utilization resources. The procedure is similar to NST.

Intrapartum fetal monitoring

Various methods have been used for fetal monitoring during labour like intermittent auscultation, cardiotocography, fetal stimulation tests, fetal scalp blood pH, umbilical blood gas analysis, intrapartum Doppler, fetal ECG and pulse oximetry.

Cardiotocography

Electronic fetal heart rate monitoring can be done by either internal or external electrodes. The fetal heart rate is studied for baseline rate, variable accelerations and decelerations and tocography includes, frequency of contractions, contractions strength, fetal movements and maternal pushing movement.

The NICHD (National Institute of Child Health and Human Development) fetal monitoring workshop 1997 has proposed standardized unambiguous definitions for interpretation of fetal heart rate patterns.

Rate

A rate of 120-160 bpm is generally considered to be normal. Baseline FHR less than 110 bpm is considered as bradycardia though lower normal limit is controversial. FHR between 100-120 bpm in the absence of other changes is not usually considered to represent fetal compromise and often attributed to head compression in occipitoposterior and transverse positions. Severe bradycardia (< 80 bpm) may be due to hypothermia, prolonged hypoglycemia, β blocker, congenital heart block, conduction analgesia.

Tachycardia is said to be present if FHR > 160 bpm which could be due to fetal hypoxia, fetal anemia, fetal heart failure, amnionitis. This signifies fetal compromise only in presence of concomitant decelerations.

Variability

The oscillation of baseline fetal heart rate from beat-to-beat as a result of sympathetic and parasympathetic interactions which is recorded as irregularities on the graph paper is called baseline variability.

- Short term variability: is a measure of interval between cardiac systoles and reflects instantaneous changes in fetal heart rate from one beat-to the next.
- Long term variability: Describes oscillatory changes that occur during 1 min and results in waviness of FHR tracing at frequency of 3-5 cycles per min.

Periodic changes

Acceleration: An increase in FHR of 15 bpm for 15-20 sec. It represents fetal alertness or arousal state. It is a reassuring pattern.

Deccelaration:

Early decceleration: it begins early in uterine contractions and nadir occurs at peak of contractions and returns to baseline before completion of contraction. This is usually due to head compression and also has been associated with fetal hypoxia or acidosis.

Late Decceleration*:* It is a smooth gradual symmetrical decrease in FHR beginning at or after the peak of the uterine contraction and returns to baseline only after the contraction has ended.

Variable decceleration*:* It is the most common deceleration pattern encountered during labour, defined as visually apparent abrupt decrease in rate, onset varying with successive contractions. Often it is due to cord compression.

Variable deceleration may have shoulder of acceleration before and after the deceleration or may have abrupt deceleration. This variation is caused by varying degree of cord occlusion. Occlusion of only the vein reduces the fetal blood return which triggers baro receptor mediated acceleration. Subsequent complete occlusion results in fetal systemic hypertension due to obstruction of umbilical artery. This stimulates baroreceptor mediated decelerations. The after coming shoulder of accelerations represents same event in reverse.

Prolonged Deccelerations*:* Defined as isolated decelerations lasting more than 2 min but less than 10 min. Some of the common causes include uterine hyperactivity, cord entanglement, supine hypotension, cervical examination and epidural analgesia.

Sinusoidal heart rate: A sinusoidal pattern of fetal heart rate has a stable baseline heart rate of 120-16 bpm, amplitude of 5-15 bpm, fixed or flat short term variability, oscillation of sinusoidal waveforms above or below the baseline and absence of accelerations. These have been observed in serious fetal anemia of any cause, also in meperidine and morphine therapy, fetal distress and umbilical cord compression.

Intrapartum stimulation tests

These have been developed to overcome the disadvantages of FBS in evaluating fetuses with suspicious FHR traces during labour.

1. **Scalp Stimulation Test:** Can be done by firm digital pressure or gentle pinch by an atraumatic Allis tissue forceps. If an acceleration is observed it is invariably associated with pH > 7.2 conversely of fetuses which fail to respond only 30-40% would have pH below 7.2.
2. **Vibroacoustic stimulation:** Can be used as an alternative to FBS. Most non- acidotic fetuses show FHR acceleration. About 50% of non-responders would have scalp pH < 7.2, hence may require FBS.

Fetal Scalp Blood Sampling

Measurement of pH in capillary scalp blood may help to identify acidotic fetus. If pH is > 7.26, labour is observed, if between 7.2 and 7.26 measurement is repeated after 30 min. If pH is less than 7.2 it is repeated immediately and if acidosis is confirmed delivery is conducted promptly. The greatest benefit of FBS is reduced caesarean delivery.

The obvious disadvantages are its invasive nature, cumbersome procedure, unacceptable time requirement, necessity and difficulty of repeating, high skill requirement, sophisticated equipment and immediate laboratory facility, risk of contamination with liquor etc.

Other intrapartum fetal surveillance tests include

1. Fetal electrocardiography
2. Fetal Pulse Oximetry

3. Intrapartum Doppler Velocimetry.
4. Fetal scalp lactate measurement.
5. Near infrared Spectroscopy (NIRS)

CORD BLOOD pH

In 1958, James et al [72] recognised that umbilical cord blood gas analysis can give an indication of preceding fetal hypoxic stress. It has since become widely accepted that umbilical cord blood gas analysis can provide important information about the past, present and possibly the future condition of the infant. Umbilical cord blood gas analysis is now recommended in all high-risk deliveries by both the British and American Colleges of Obstetrics and Gynaecology [73]and in some centres it is practised routinely following all deliveries. It is therefore of increasing clinical and medicolegal importance that clinicians caring for newborn infants are familiar with the principles and practice of obtaining and interpreting cord blood gas values, and with the underlying evidence base.

Evaluation of fetal acidosis

The pH of umbilical cord blood is determined by presence of respiratory and metabolic acids. Carbon dioxide diffuses readily across the placenta. Fixed acids such as lactic acid and b-hydroxybutyrate, which account for the majority of the metabolic load, have a relatively slow passage across the placenta.[74] It is important to evaluate both the respiratory and metabolic components of each sample. Isolated fetal respiratory acidosis is usually the result of short lived impairment of the uteroplacental or fetoplacental circulation and is seldom associated with adverse outcome. Ongoing impairment results in progressive metabolic acidosis due to anaerobic glycolysis. Consequently most severe fetal acidosis is mixed. Although it is the most commonly quoted figure, pH is not an ideal parameter for estimating the cumulative exposure to hypoxia. The change in hydrogen ion concentration associated with a fall in pH from 7.0 to 6.9 is almost twice that which is associated with a fall in pH from 7.3 to 7.2. Uterine contraction during the second stage of labour may impair placental flow, although periodic relaxation usually allows restitution of gas exchange unless placental function is already poor. In cases of excessive contraction such as during uterine hyperstimulation or prolonged second stage, incomplete restitution may result in cumulative acidosis. Interrupted placental perfusion also occurs during maternal hypotension, as seen in acute blood loss, regional anaesthesia and systemic illness, as well

as during placental abruption and acute cord compression.32 Uncomplicated labour changes base excess by around 3 mmol/l overall. A normal second stage of labour changes it by around 1 mmol/l per h. In contrast, base excess changes by around 1 mmol/l per 30 min during prolonged periods when there are repeated fetal heart rate decelerations. The most profound fetal compromise, such as that associated with terminal bradycardia following acute uterine rupture, changes base excess by 1 mmol/l per 2–3 min.

FACTORS WHICH INFLUENCE CORD BLOOD VALUES

Infants born by elective caesarean section without labour have results which are closer to normal adult values (higher pH, PO2, base excess and bicarbonate, and lower PCO2), as do infants born of multiparous mothers. The repeated uterine contractions of normal labour exert appreciable metabolic stress on the fetus. This effect is exaggerated in twin labour at full term, where the time-related deterioration of arterial cord pH is more precipitous in the second twin. Regional anaesthesia, particularly spinal anaesthesia is associated with increased incidence of cord blood acidosis. Sympathetic blockade reduces uteroplacental perfusion. The resultant carbon dioxide retention is manifest by predominantly respiratory acidosis, but there is no evidence that this affects clinical outcome.

Although there seems to be a weakly positive correlation between cord pH and umbilical cord length, number of coils and number of vascular coils per centimetre, umbilical cord morphology is of uncertain clinical importance. The presence of true knotting of the cord seldom seems to cause a problem. Chorioamnionitis, with or without funisitis does not appear to influence cord blood pH or base excess. Although placental infection is associated with cerebral palsy in both term and preterm infants, the mechanism appears to be largely independent of hypoxia-ischaemia. Oligohydramnios as appears to cause impaired acid base balance ,but mostly in long term reduction of amniotic fluid .Isolated oligohydramnios and its effect on fetal blood gases is not be elucidated.

Fig no 10: NORMAL /REASSURING NST

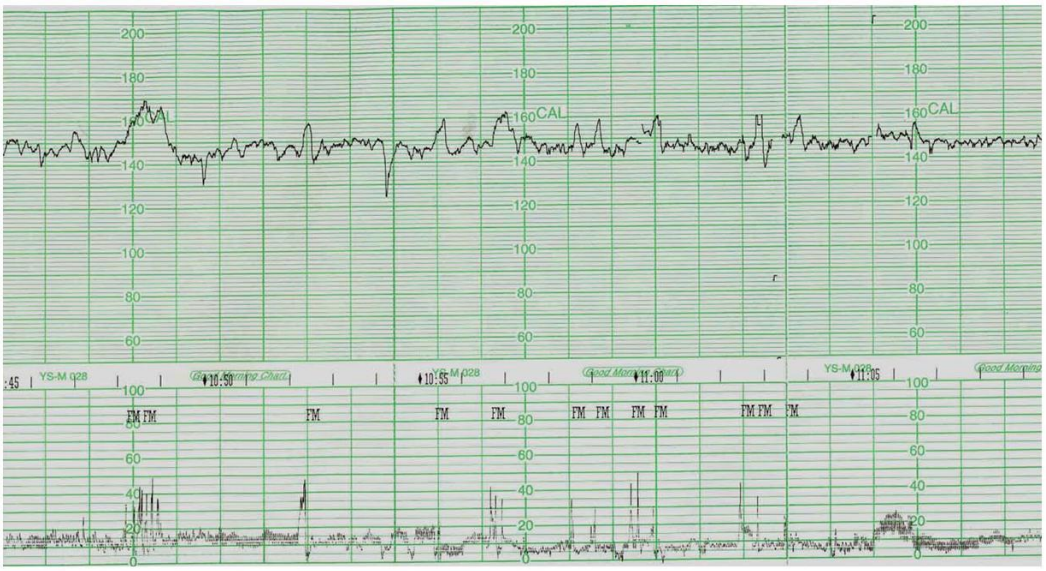


Fig No 11: VARIABLE DECELERATION

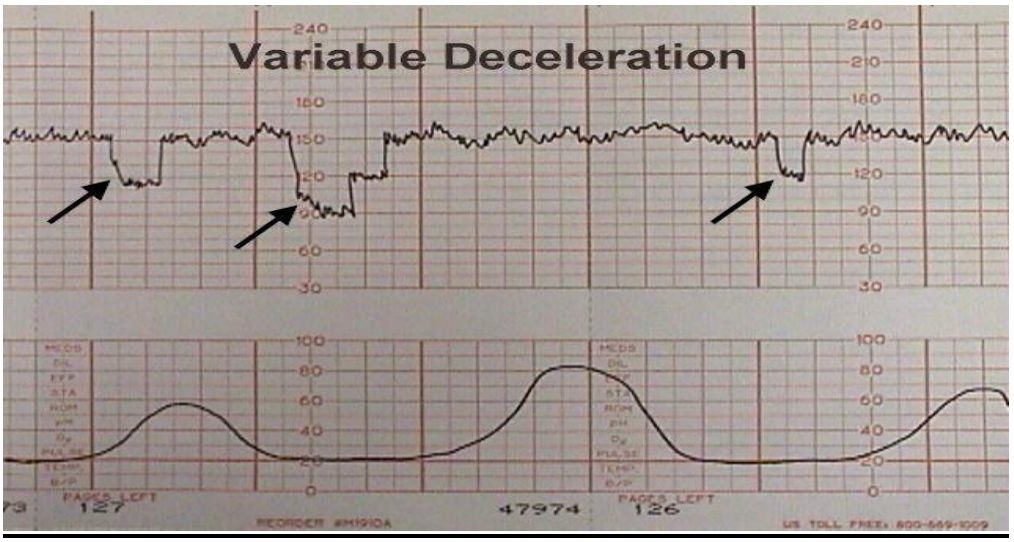


Fig No 12: EARLY DECELERATIONS

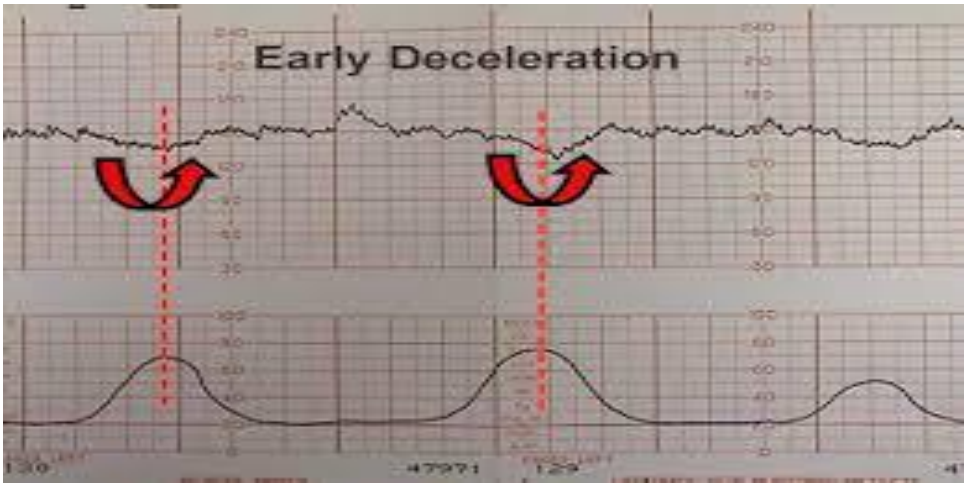


Fig No 13 : LATE DECELERATONS

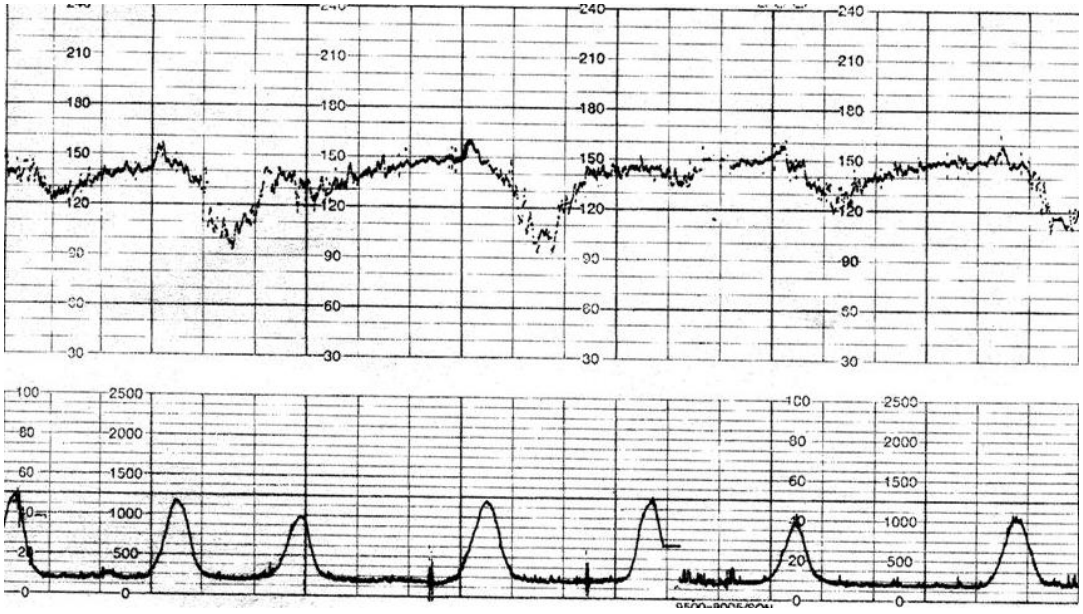
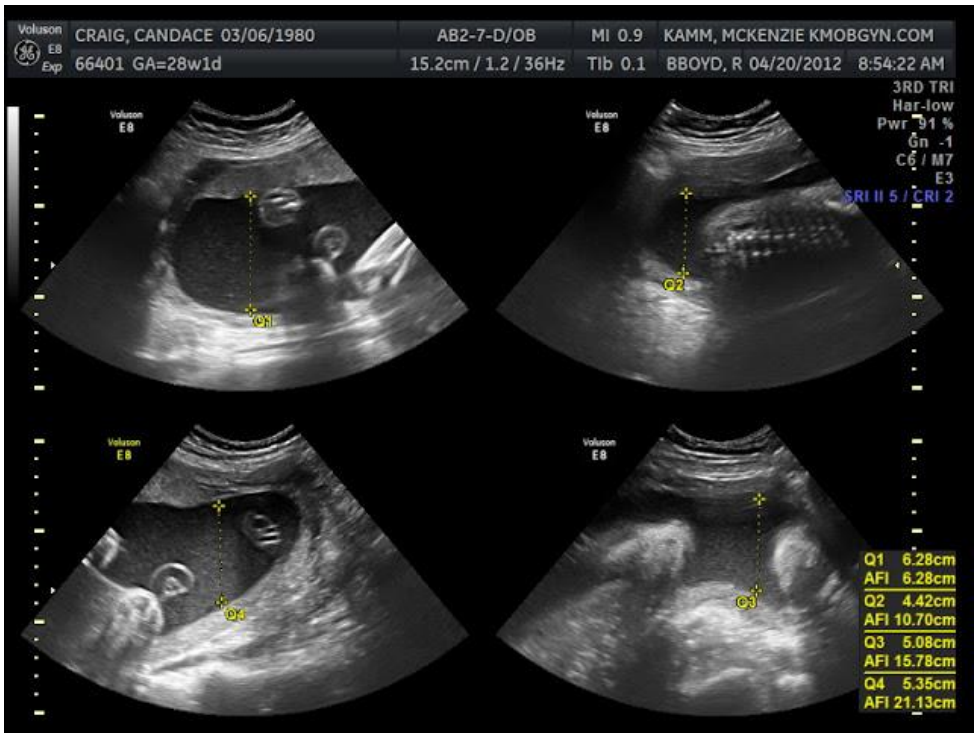


FIG No 14 : MEASUREMENT OF AFI



OBJECTIVES

OBJECTIVES

- To determine the obstetrical outcome in women with isolated oligohydramnios at term.

- To compare the obstetrical outcome in women with isolated oligohydramnios and in the control group

MATERIALS & METHODS

METHODOLOGY

This study was conducted at R L Jalappa Hospital for a period of 18 months (Nov 2015 to July 2017) and included the inpatients admitted to the labour ward during this period . Study was started after obtaining the required ethical clearance from that Institutional Ethical Committee.Total number of patients included were 100 of which 50 belonged to the isolated oligohydramnios group and 50 to the control (normal AFI) group.

Sample size:

Sample size was estimated based on the proportion of difference observed in a comparative study of oligohydramnios group and control group, in parameters like Difference of proportion of LSCS, IUGR and fetal distress with 80% power and 95% confidence interval.

The sample size for individual parameter was calculated as

IUGR – 53

LSCS-28

Fetal distress-19

Formula used: $n = 2\ \frac{\bar{P}\bar{Q}(z_{\alpha}+z_{1-\beta})^2}{(P_1-P_2)^2}$

n=100, 50-in study group and 50 controls.

A. Inclusion criteria:

- Low risk pregnancy with gestational age between 37 to 42 weeks with intact membranes.
- Singleton pregnancy.

B. Exclusion criteria:

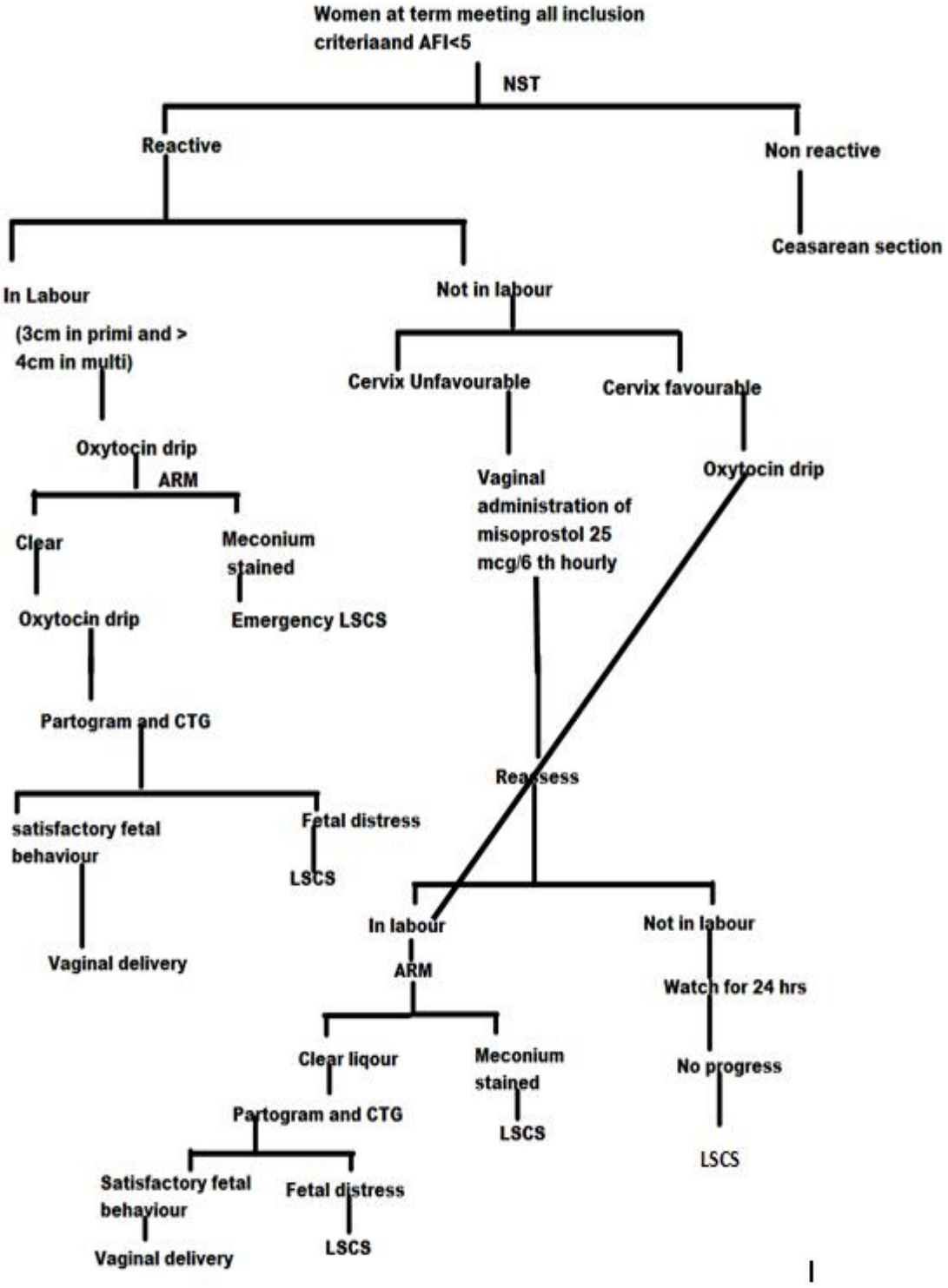
- Medical disorder of pregnancies- like diabetes, hypertension, renal disease and pre-eclampsia.
- Congenital anomalies of the fetus.

Method of collection of data:

- The patient were recruited after taking informed consent.
- Data was collected using a Proforma meeting the objectives of the study by convenience sampling method
- Women with AFI < 5 / AFV <500ml at more than 37 weeks of gestation were included in the case group.
- AFI > 5cm at term were included in the control group.
  - Detailed history, physical examination and necessary investigations were undertaken.
  - AFI was measured using Phelan's four quadrant ultrasound technique. The uterus was arbitrarily divided into four quadrants by the umbilicus transversely and the linea nigra vertically. The largest vertical pocket free of fetal parts and umbilical cord loops in each quadrant was measured and sum of these measurements provided AFI in cm. AFI of <5 was considered Oligohydramnios.
- Admission Non stress test (NST) was done for all the patients.
- Those with non-reassuring NST were further evaluated with Biophysical profile (BPP) and if BPP was abnormal, caesarean section was done.
- If NST was reassuring, labour was induced with 25 microgram pervaginal misoprostol after ruling out cephalo-pelvic dispropotion.A total of 6 doses 4^{th} hourly apart was the total dose used when required depending on the Bishops score.
- Induction was done according to ACOG guidelines for labour induction -2016.

- When patient went into Active labour artificial rupture of membranes was done, augmentation with oxytocin was done if required. Partogram was plotted to know the progress of labour.
- All cases were monitored by electronic fetal monitoring .If any fetal distress was present, operative intervention were undertaken.
- Cord blood ABG was done immediately after the birth of the baby to rule out acidosis and thus the presence of any fetal distress.
- Birth weight, APGAR scores at 1 minute and 5 minutes was noted and baby was admitted to Neonatal intensive care unit as and when required.

FLOW CHART SHOWING MANAGEMENT PROTOCOL FOR STUDY GROUP



STATISTICAL ANALYSIS

Various maternal and fatal outcomes like mode of delivery, APGAR score of the child, NICU admission etc. were considered as outcome variables.

Presence or absence of Oligohydramnios was considered as Primary explanatory variable

Various demographic and obstetric parameters were considered as potential explanatory variables.Variables

Descriptive analysis: Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram, pie diagram and box plots.

Both the study groups (Oligohydramnios and control group) were compared with respect to all the potential confounding baseline variables. The association between Oligohydramnios and outcomes was assessed by cross tabulation and comparison of percentages. Chi square test was used to test statistical significance. In cross tabulation with any individual cell count less than 5, fisher's exact test was used to assess statistical significance.

P value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

RESULTS

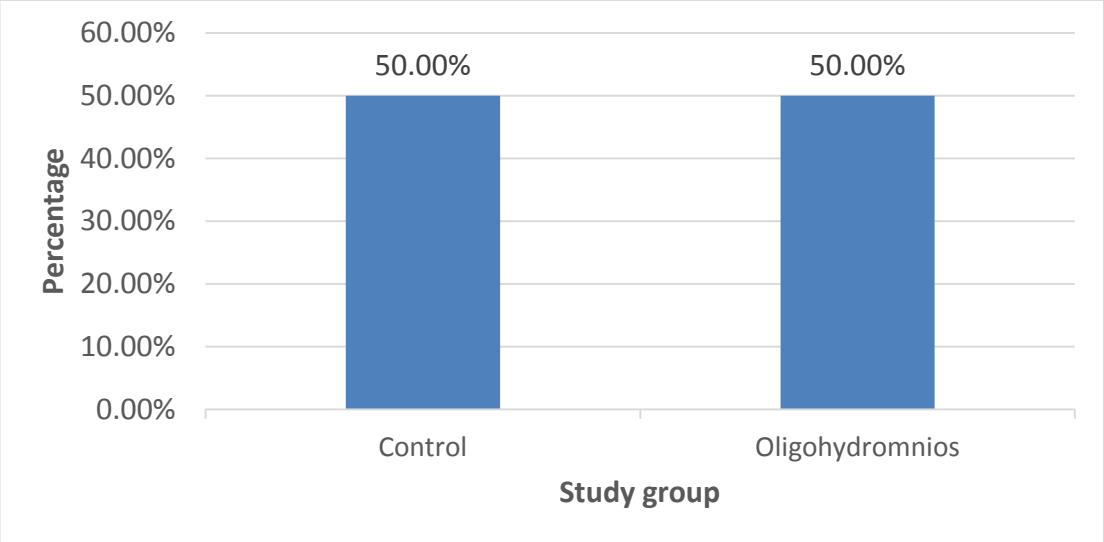
RESULTS

Among the population included, the 50 people were controls and 50 people had Oligohydromnios.(Table 1 and fig 1)

Table 1: Descriptive analysis of Study group in study population (N=100)

Study group	Frequency	Percentage
Control	50	50.00%
Oligohydromnios	50	50.00%

Fig 1: Bar chart of distribution of study population (N=100)



Among both cases and controls higher proportion of subjects were age between 24 to 26 years followed by 21 to 23 years. There was no statistically significant difference BETWEEN BOTH THE GROUPS IN AGE DISTRIBUTION (P value 0.79). (Table 2)

Table 2: Distribution of Study population depending on Age(N=100)

Age group	Study group		Chi square	P-value
	Control (N=50)	Oligohydramnios (N=50)		
18-20	10 (20%)	12 (24%)	1.691	0.79
21-23	17 (34%)	15 (30%)		
24-26	18 (36%)	15 (30%)		
27-29	4 (8%)	5 (10%)		
≥30	1 (2%)	3 (6%)		

Fig 2: Bar chart showing Age group distribution in study population (N=100)

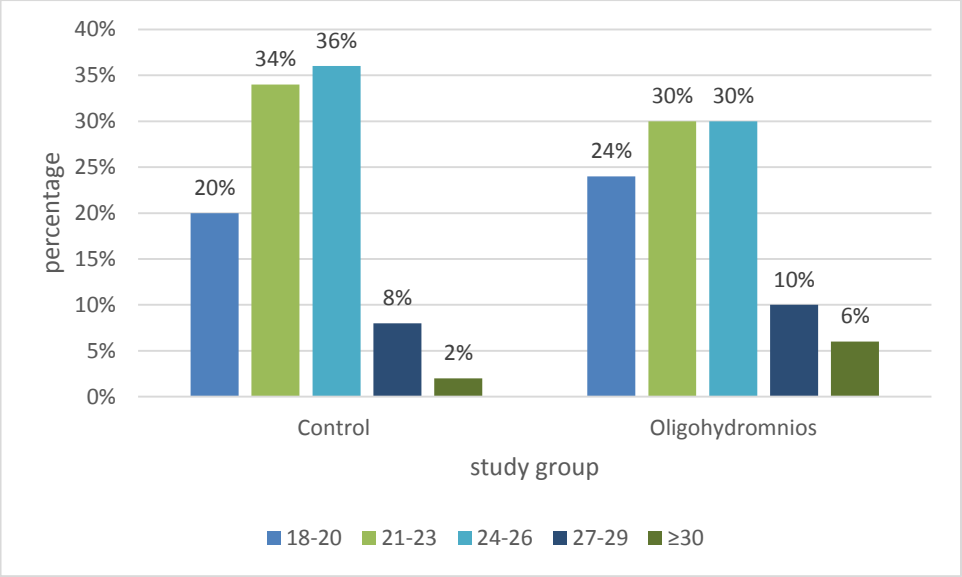


Table 3: Distribution of study population based on Gravida (N=100)

Gravida	Study group		Fishers' exact test Chi square	P-value
	Control(N=50)	Oligohydromnios(N=50)		
Primi gravida	24 (48%)	32 (64%)	9.657	**0.02**
Gravida-2	21 (42%)	9 (18%)		
Gravida-3	4 (8%)	3 (6%)		
Gravida-4	1 (2%)	6 (12%)		

Among the oligohydramnios group higher proportion of women were primigravida (64%), as compared to 48% in controls. Also the proportion of women with gravida-4 was higher in oligohydramnios group was higher (12% Vs 2%) as compared to controls. Among the controls higher proportion of women were present in gravida-2. THE DIFFERENCES IN GRAVIDITY BETWEEN THE TWO GROUPS WERE STATISTICALLY SIGNIFICANT (P value 0.02) (Table 3 and Fig 3)

Fig 3: Bar chart of gravida distribution in study population (N=100)

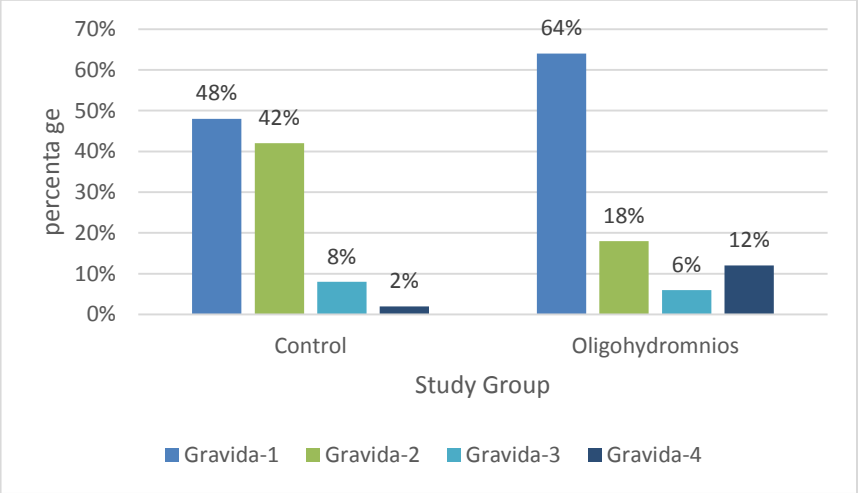


Table 4: Distribution of study population based on parity (N=100)

Parity	Study group	
	Control(N=50)	Oligohydromnios(N=50)
Nulliparous	23 (46%)	32 (64%)
P1	25 (50%)	13 (26%)
P2	2 (4%)	3 (6%)
P3	0 (0%)	2 (4%)

Among the Control group 23 (46%) were nulli parous women, 25 (50%) were Para-1 and 2(4%) were Para 2.In the Oligohydramnios group 32 (64%)were nulliparous women, 13(26%) were Para-1 subjects, 3(6%) in Para-2 subjects and 2(4%) were Para-3 subjects.The mean parity was 1.6 .(No statistical test was applied considering "0" subjects in one of the cells).(Table 4 and Fig 4)

Fig 4: Bar chart of parity distribution in study population (N=100)

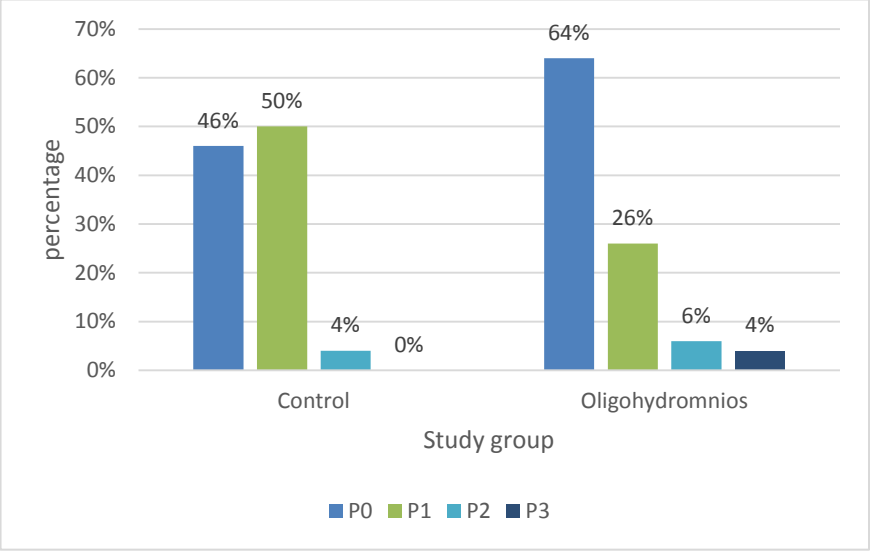


Table 5: Gestational age distribution of study population (N=100)

Gestational age	Study group		Fishers' exact test Chi square	P-value
	Control(N=50)	Oligohydromnios(N=50)		
37-weeks to 37+6days	4 (8%)	13 (26%)	11.34	**0.02**
38-weeks to 38+6days	7 (14%)	13 (26%)		
39-weeks to 39+6days	11 (22%)	10 (20%)		
40-weeks to 40+6days	23 (46%)	11 (22%)		

Among the Control group - 4 (8%) were of gestational age of 37-weeks. The number of subjects with gestational age of 38, 39 and 40 weeks was 7 (14%), 11(22%) and 0(0%) respectively. In Oligohydromnios group 13 (26%) women were of 37-weeks gestational age. The number of subjects belonging to 38, 39 and 40 weeks of gestational age was 13(26%), 10(20%) and 11(22%) respectively. THE DIFFERENCE BETWEEN THE GROUPS WITH REGARDS TO GESTATIONAL AGE WAS STATISTICALLY SIGNIFICANT (P value 0.02).(table 5 and fig 5)

Fig 5: Bar chart of gestational age distribution in study group (N=100)

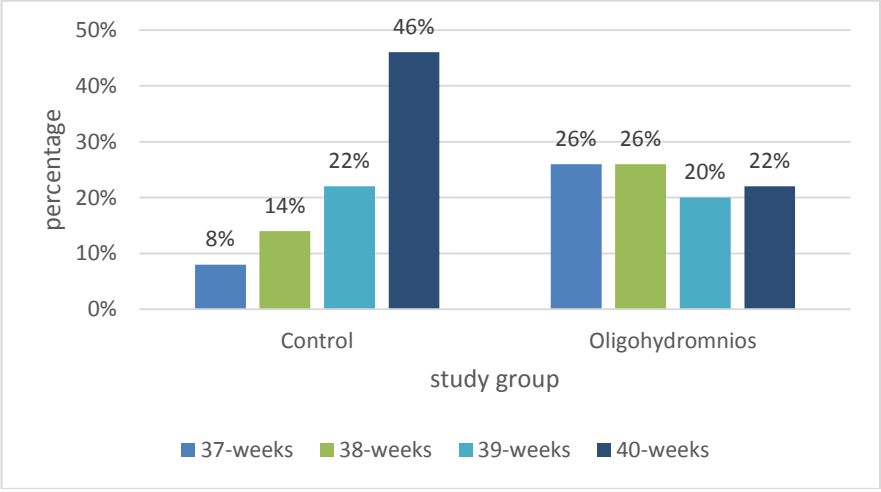


Table 6: Admission NST of study population (N=100)

Admission NST	Study group		Chi square	P-value
	Control(N=50)	Oligohydromnios(N=50)		
Reassuring	48 (96%)	42 (84%)	4.000	**0.05**
Non-reassuring	2 (4%)	8 (16%)		

Among the Control group, 48 women (96%) had reassuring NST at admission and 2(4%) were Non-reassuring. The number of reassuring and non-reassuring NST was 42 (84%) and 8(16%) Oligohydramnios group. THE DIFFERENCE BETWEEN STUDY GROUPS WITH REGARDS TO ADMISSION NST WAS **STATISTICALLY SIGNIFICANT** (P value 0.05).(Table 6 and Fig 6)

Fig 6: Bar chart of Admission NST distribution in study group (N=100)

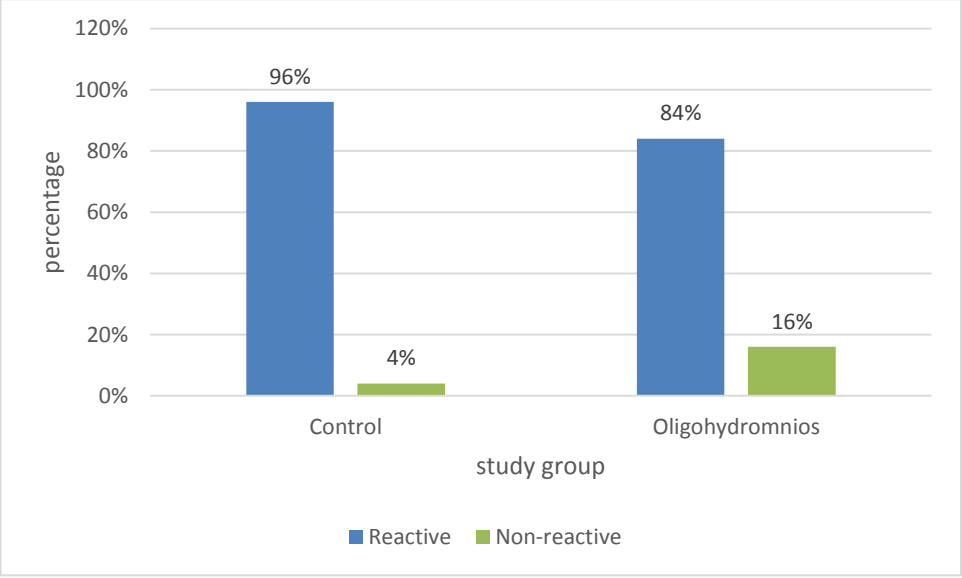


Table 7: Distribution of NST patterns among the study population (N=100)

NST patterns	**Study group**	
	Control(N=50)	**Oligohydromnios(N=50)**
Reassuring	48 (96%)	42 (84%)
Early	1 (2%)	1 (2%)
variable	1 (2%)	6 (12%)
Late	0 (0%)	1 (2%)

Among the Control group 1(2%) woman each had early and variable NST pattern. Among the Oligohydramnios group 1(2%) woman each had early and late deceleration and 6(12%) women had variable deceleration. (Table 7 and Fig 7)

Fig 7: Bar chart of NST pattern distribution in study population (N=100)

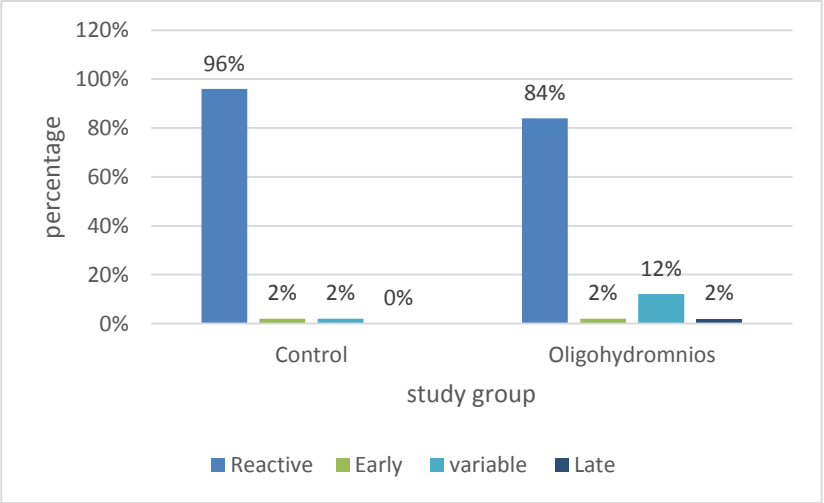


Table 8: Association of NST pattern with AFI in Oligohydramnios group (N= 50)

AFI	NST patterns			
	Reassuring	**Early deceleration**	**variable deceleration**	**Late deceleration**
0-1.0	0 (0%)	1 (20%)	3 (60%)	1 (20%)
1.1-2.0	7 (70%)	0 (0%)	3 (30%)	0 (0%)
2.1-3.0	10 (100%)	0 (0%)	0 (0%)	0 (0%)
3.1-4.0	9 (100%)	0 (0%)	0 (0%)	0 (0%)
4.1-5.0	16 (100%)	0 (0%)	0 (0%)	0 (0%)

In the AFI group 0f 0 to 1 cm, 3 women had variable deceleration,1 each of early and late deceleration at admission and no reassuring NST. Women with 1-2 cm AFI 3 had variable deceleration. Women with AFI >2 cm all had reassuring NST. (Table 8)

Table 9: Distribution of onset of labor in the study population (N=100)

onset of labor	Study group		Fishers' exact test Chi square	P-value
	Control(N=50)	**Oligohydromnios (N=50)**		
spontaneous	32 (64%)	22 (44%)	4.026	**0.04**
induced	18 (36%)	28 (56%)		

Among the Control group 32 (64%) went into spontaneous labour and 18(36%) were induced. The number of Spontaneous and Induced subjects were 22(44%) and 28(56%) Oligohydramnios group. THE DIFFERENCE BETWEEN STUDY GROUPS WITH ONSET OF LABOUR WAS STATISTICALLY SIGNIFICANT (P value 0.04).(Table 9 and Fig 8)

Fig 8: Bar chart of distribution of study population based on onset of labor (N=100)

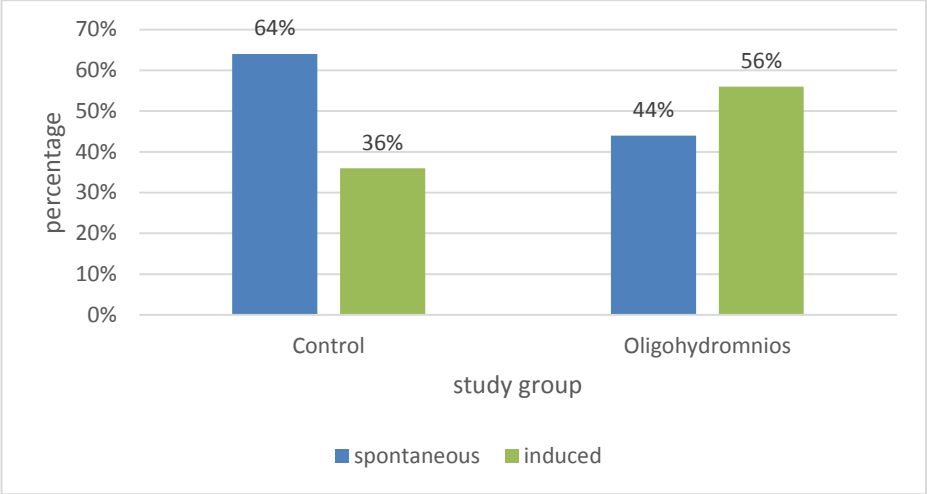


Table 10: Mode of delivery of among the study population (N=100)

Mode of delivery	Study group		Fishers' exact test Chi square	P-value
	Control(N=50)	**Oligohydromnios(N=50)**		
Normal Vaginal Delivery	34 (68%)	27 (54%)	8.172	**0.04**
Forceps	2 (4%)	2 (4%)		
vacuum	10 (20%)	6 (12%)		
LSCS	4 (8%)	15 (30%)		

Among the Control group -34(68%) women had Normal Vaginal Delivery. The number of Forceps, Vacuum and LSCS delivery was 2(4%), 10(20%) and 4(8%) respectively. In the Oligohydramnios women 27(54%) had normal vaginal delivery. The number of Forceps, Vacuum and LSCS delivery was 2(4%), 6(12%) and 15(30%) respectively. THE DIFFERENCE BETWEEN STUDY GROUPS WITH REGARDS TO MODE OF DELIVERY WAS STATISTICALLY SIGNIFICANT (P value 0.04). (Table 10)

Table 11: Distribution of the study group based on indication for caesarean (N=19)

Indication for caesarean	Study group		Chi square	P-value
	Control(N=4)	**Oligohydromnios(N=15)**		
Fetal distress	2 (50%)	8 (53.33%)	.048a	0.98
Meconium	1 (25%)	4 (26.66%)		
Non-progression	1 (25%)	3 (20%)		

Among the Control group the 2 (50%) women were taken for LSCS in view of fetal distress. The number of women taken for LSCS in view of meconium stained liquor and Non-progression of labour were 1(25%) and 1(25%) respectively. In the Oligohydromnios group, 8(53.33%) of women had Fetal distress. The number of woman with meconium stained liquor and non-progression of labour was 4(26.66%) and 3(20%) respectively. THE DIFFERENCE BETWEEN STUDY GROUPS WITH RESPECT TO INDICATION FOR CAESAREAN WAS STATISTICALLY NOT SIGNIFICANT (P value 0.98). (Table 11)

Fig 9: Bar chart of distribution of study group based on Indication for caesarean (N=19)

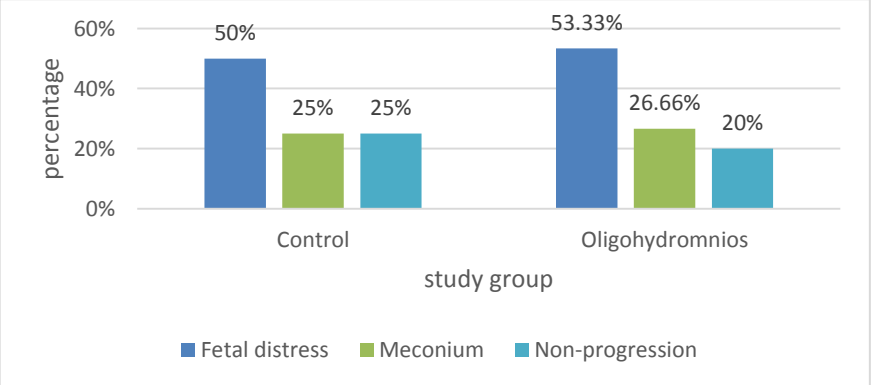


Table 12: Association of Mode of delivery with AFI in the study population (N=50)

AFI	Mode of delivery			
	NVD	**Forceps**	**vacuum**	**LSCS**
0-1.0	0 (0%)	0 (0%)	0 (0%)	5 (100%)
1.1-2.0	2 (20%)	0 (0%)	0 (0%)	8 (80%)
2.1-3.0	6 (60%)	0 (0%)	2 (20%)	2 (20%)
3.1-4.0	6 (66.67%)	0 (0%)	3 (33.33%)	0 (0%)
4.1-5.0	13 (81.25%)	2 (12.5%)	1 (6.25%)	0 (0%)

All the women with AFI in the range of 0-1 cm were all taken for LSCS in view of fetal distress. 8 women in the AFI group ranging from 1.1-2.0cm were taken up for LSCS, and 2 women in the AFI range of 2.1-3.0cm were taken up for LSCS .2 women in the AFI 2.1-3.0 had vaccum assisted delivery when compared to the 3 women in the AFI 3.1-4.0.(Table 12)

Table 13: Distribution of Study group with regards to birth weight (N=100)

birth weight	Study group		Fishers' exact test Chi square	P-value
	Control (N=50)	**Oligohydromnios (N=50)**		
2.0-2.5 kg	15 (30%)	30 (60%)	13.44	**<0.001**
>2.5-3.0 kg	30 (60%)	12 (24%)		
>3.0-3.5 kg	4 (8%)	6 (12%)		
>3.5 kg	1 (2%)	2 (4%)		

Among the Control group 15 (30%) women had babies with birth weight 2.0-2.5kg. The number of women with babies with birth weight >2.5-3.0 kg, >3.0-3.5 kg and >3.5 kg was 30(60%), 4(8%) and 1(2%) respectively. In the Oligohydromnios group 30(60%) women had babies with birth weight 2.0-2.5kg. The number of babies with birth weight >2.5-3.0 kg, >3.0-3.5 kg and >3.5 kg was 12(24%) , 6(12%),and 2(4%)respectively. THE DIFFERENCE BETWEEN GROUPS WITH REGARDS TO BIRTH WEIGHT WAS STATISTICALLY SIGNIFICANT (P value <0.001).(Table 13)

Table 14: Association of birth weight with AFI of study population (N=50)

AFI	birth weight			
	2.0-2.5 kg	**>2.5-3.0 kg**	**>3.0-3.5 kg**	**>3.5 kg**
0-1.0	3 (60%)	2 (40%)	0 (0%)	0 (0%)
1.1-2.0	2 (20%)	6 (60%)	1 (10%)	1 (10%)
2.1-3.0	6 (60%)	2 (20%)	2 (20%)	0 (0%)
3.1-4.0	6 (66.67%)	2 (22.22%)	1 (11.11%)	0 (0%)
4.1-5.0	13 (81.25%)	0 (0%)	2 (12.5%)	1 (6.25%)

30 neonates in the oligohydramnios group had a birth weight <2.5 kg ,out of these 13 neonates were born to women with AFI in the range of 4.1-5 cm .The no of neonates with birth weight <2.5 kg was 3 , 2 ,6 ,6 in women with AFI in the range of 0-1.0cm,1.1-2.0cm ,2.1-3.0cm and 3.1-4.0 cm respectively

Table 15: Distribution of the study population based on APGAR at 1 min (N=100)

APGAR at 1min	Study group		Chi square	P-value
	Control (N=50)	**Oligohydromnios (N=50)**		
5	1 (2%)	1 (2%)	.710a	0.70
6	2 (4%)	4 (8%)		
7	47 (94%)	45 (90%)		

Among the control group 1 (2%) neonate had an APGAR at 1 min of 5.The number of neonates with APGAR of 6 and & 7 at 1 min was 2(4%) and 47(94%) respectively. In the Oligohydromnios group 1(2%) neonate had an APGAR at 1 min of 5. The number of neonates with APGAR of 6 and & 7 at 1 min was 4(8%) and 45(90%) respectively. THE DIFFERENCE BETWEEN STUDY GROUPS OF NEONATES WITH APGAR AT 1 MIN WAS STATISTICALLY NOT SIGNIFICANT (P value0.70). (Table 15)

Table 16: Distribution of study group based on Apgar at 5 min

Apgar at 5 min	Study group		Chi square	P-value
	Control (N=50)	**Oligohydromnios (N=50)**		
7	1 (2%)	1 (2%)	1.043	0.59
8	1 (2%)	3 (6%)		
9	48 (96%)	46 (92%)		

Among the control group 1 (2%) neonate had Apgar at 5 min of 7.The number of neonates with 8 and 9 APGAR at 5 min were 1(2%) and 48(96%) respectively. In the Oligohydromnios group 1(2%) neonate had APGAR at 5 min of 7.The number of neonates with 8 and 9 as APGAR at 5 min were 3(6%) and 46(92%) respectively. THE DIFFERENCE BETWEEN STUDY GROUPS WITH REGARDS TO APGAR AT 5 MIN WAS STATISTICALLY NOT SIGNIFICANT (P value0.59). (Table 16)

Table 17: No of NICU admission in the study population (N=100)

NICU admission	Study group		Chi square	P-value
	Control(N=50)	**Oligohydromnios(N=50)**		
yes	2 (4%)	6 (12%)	2.174	0.14
No	48 (96%)	44 (88%)		

Among the control group only two neonates were admitted in NICU, the number of neonates from oligohydromnios group who were admitted to NICU was 6(12%). THE NO OF NICU ADMISSION BETWEEN THE TWO GROUPS WAS NOT STATISTICALLY SIGNIFICANT (P value 0.14).(Table 17 and fig 10)

Fig 10: Bar chart of No of NICU Admission in study group (N=100)

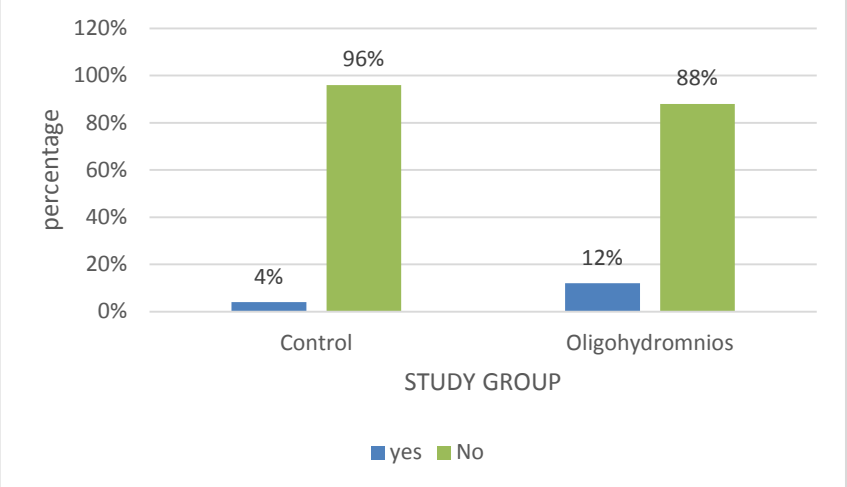
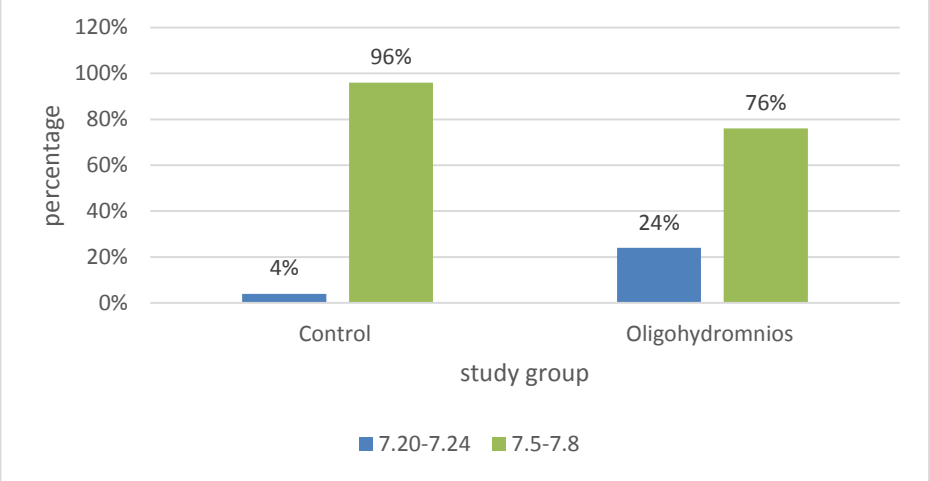


Table 18: Distribution of Study group based on Cord blood pH (N=100)

Cord blood pH	Study group		Chi square	P-value
	Control (N=50)	**Oligohydromnios (N=50)**		
7.20-7.24	2 (4%)	12 (24%)	8.306	**<0.001**
7.25-7.28	48 (96%)	38 (76%)		

Among the control group 2 (4%) neonate had a cord blood pH of 7.20-7.24, and 48(96%) had a cord blood pH of 7.5-7.8. In the oligohydromnios group 12 (24%) neonates had a cord blood pH of 7.20-7.24, and 48(96%) had a cord blood pH of 7.5-7.8. THE DIFFERENCE BETWEEN STUDY GROUPS WITH REGARDS TO CORD BLOOD PH WAS STATISTICALLY SIGNIFICANT (P value <0.001) with 12 neonates having a cord blood pH in the lower range of the normal value (Table 18)

Fig 11: Bar chart of Cord blood pH distribution between study group (N=100)



DISCUSSION

DISCUSSION

A prospective comparative study conducted in SDUMC, Kolar from November 2015 to July 2017, which was conducted to analyze the pregnancy outcome in term isolated oligohydramnios and normal term pregnancies after matching the demographic variables.

The various outcome results are compared with results of similar studies done both in India and abroad.

Gravidity and parity wise analysis:

The mean gravidity in present study is 1.3 which is comparable to mean gravidity of 2 in study by Baron et al. The mean parity is 1.3 which was higher than that of mean parity of 1 in Baron. et al study and 0.6 in study by Magann et al.

Gestational Age at time of presentation:

It was noted that women with normal AFI tend to continue upto 40 weeks gestation with no fetal or maternal compromise when compared to women with reduced AFI who presented at 38 weeks. This could be due to increased fetal surveillance and thus early intervention in the oligohydramnios group.

Non-Reassuring Non Stress Tests:

The non-reassuring NST rates are high in women with AFI <5 cm. There was statistically significant difference in the occurance of non-reassuring NST in the oligohydramnios group and control group. The rate of non-reassuring NST is 40%, 69.23%and 41% in studies conducted by Kumar P et al, Chandra et al,Sriya R et al respectively. In present study only 16% cases had non reassuring NST this was less when compared to other similar study.

FHR Decelerations:

The FHR decelerations, during intrapartum period suggestive of fetal distress are common in pregnant women with AFI $\leq$ 5 cm. Most common are variable decelerations due to cord

compression. The variable deceleration was noted in 6% in present study, which is less compared to 48% and 36.11% in studies by Casey et al. and Sriya R. et al. respectively.

Occurrence of Meconium Stained Liquor:

The occurrence of meconium stained amniotic fluid is high in women with AFI ≤ 5 cm. The meconium stained liquor was noted in 26.66% of the study group in present study which is comparable to study conducted by Chandra P et al(23.7%).The studies by Rutherford et al and Sriya R et al had meconium stained liquor about 54% and 38.88% respectively. In a study by Grubb et al 99% of women with AFI ≤5 cm and prolonged deceleration, had meconium stained liquor.

According our study protocol meconium stained liquor cases were taken up for emergency LSCS.

LSCS for Fetal Distress:

Various studies show different rates of LSCS for fetal distress in pregnant women with amniotic fluid index of ≤5 cm. The LSCS for fetal distress was done in 30% in present study which is compared with the situations in other studies. The LSCS rates were 76.92%,51%,43.93% respectively with study conducted by Chandra P et al, Casey et al, Sriya P et al .Oligohydramnios (AFI ≤5 cm) has been used as a screening test for the development of fetal distress, subsequently during intrapartum period.

Including only isolated oligohydramnios cases in our study may be the cause for decrease in LSCS rates for fetal distress.

The rate of LSCS was more in those with oligohydramnios and non-reassuring NST (100%). Even with reassuring NST 14% later underwent LSCS for reasons like thick meconium and fetal distress. In control group women with non-reassuring NST had 100% cesarean rate and with reassuring NST had only 2% of cesarean rates.In the control group 2% had non reassuring NST. 6% had thick meconium stained liquor and 8% cesarean section rates.

Birth weight:

In this study it was seen that there was statistically significant difference between the

birth weight of the neonates born to women with AFI <5 cm (15 vs 30). This correlated with the findings of other studies like Chandra et al and Sriya et al which also showed a higher rate of low birth weight babies in the study group.

APGAR score < 7 at 5 Minutes:

The 5 min APGAR score < 7 is seen in 2% of oligohydramnios group. Whereas 5 min APGAR less than 7 in other studies like Rutherford et al, Chandra P et al, Sriya R et al are 23%,23.07% and 9.72% respectively. This could be due to the fact that the above mentioned studies included oligohydramnios due to high risk maternal factors also, whereas the present study included only isolated oligohydramnios.

Admission to Neonatal Ward:

Twelve percent of newborns were admitted in neonatal ward for various morbidities like birth asphyxia, meconium aspiration etc from study group. It is comparable to studies conducted by Magann et al (7.6%) and Casey et al (7%).

Studies by Chandra P et al and Sriya R et al showed high incidence of NICU admission i.e 46.15% and 88.88% respectively.

Among cases and controls there was no neonatal death. In Chandra P et al. study neonatal death occurred in one case. In study by Baron et al. and Casey et al. there was no mortality probably because of good neonatal intensive care unit facilities.

Cord Blood pH:

The normal range of the cord blood pH in a new born is 7.2-7.28 immediately after birth. No babies in the study population had a pH <7.20,thus proving that none of these neonates suffered from birth asphyxia which would lead to long term squealae.There was a statistically significant difference in the number of neonates in the study group which had cord blood pH in the lower end of the normal range (12% vs 2%)

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Merits of the study:

1. While conducting this study patients with isolated oligohydramnios were promptly identified and were induced according to ACOG 2016 guidelines with low dose misoprostol (25 mcg 4^{th} hourly) and under continuous monitoring vaginal delivery was done with only 30% LSCS and 6% neonatal morbidity. The low dose of misoprostol also helped reduce the number of patients ending up with fetal distress. Thus reducing the number of non-indicated LSCS.

2. Cord blood pH can be used as an useful tool to determine birth asphyxia in newborn and hence predict long term sequelae lie Intraventricular hemorrhage and Hypoxic ischemic encephalopathy.

Limitation of this study:

1. Small sample size.

2. The diagnosis of fetal distress was made depending on FHR tracings. However the fetal acidosis was not proved by fetal scalp blood sampling or other methods because of non –availability, which might have altered the outcome.

3. Neonatal follow up after 7 days was lacking.

SUMMARY

SUMMARY

This is a prospective comparative study of 50 pregnant women of more than 37 weeks of gestation with AFI < 5 cm compared with women having Normal AFI. Other variables like age, parity, gestational age were matched in both the groups. This is done over a period of 18 months from Nov 2015 to July 2017 at RL.Jalappa Hospital and Research Centre,Tamaka ,Kolar.

- The mean age for study group and control group were 22.54 years and 22.24 years respectively.

- Most of the patients in the study group were Primigravida.

- Only those with good dates were taken for study and all had completed thirty seven weeks of gestation and mean gestational age was 37.56 weeks for study and 39.36 for control group.

- The amniotic fluid index was measured by four quadrant semiquantitative technique in ultrasound and those with AFI <5 cm were considered as oligohydramnios and those with AFI between 8 cm and 20 cm were considered normal. The mean AFI in oligohydramnios group was 3.21 cm and mean AFI for control group was 10.83 cm.

- The occurrence of non-reassuring NST was 16% in study group compared to 2 % in control groups (P-0.09).

- The FHR decelerations in CTG were recorded more often in oligohydramnios group and variable decelerations were the commonest type. The study showing p=0.24 which is non-significant statistically.

- The occurrence of thick meconium stained amniotic fluid was more than twice in oligohydramnios group compared to control group.

- Induction of labor was also more common in oligohydramnios group compared to control group. The difference was statistically significant (P<0.04).

- LSCS rates were more among patients with AFI 0-1.

- 16% of women with AFI <5 cm developed fetal distress. All of them were delivered by cesarean section. The difference in occurrence of fetal distress in study group and control group was statistically significant (P = 0.04).
- Occurrence of cesarean section was high if oligohydramnios was associated with non-reassuring NST.(p<0.04)
- Mean 1 min APGAR score was 6.8 and 6.7 in study and control groups respectively. It's not statistically significant (p-0.70). Mean 5 min APGAR score was 8.8 and 8.7 in study and control groups respectively, which is also not statistically significant.(0.59)

- The mean birth weight was 2.44 Kg in study group and 2.74Kg in control group.. The difference in the mean birth weight was statistically significant (<p-0.001).

- Neonates (12%) of study group were admitted to neonatal ward for morbidities like respiratory distress , low birth weight and meconium aspiration. 2 neonates from control group was admitted to neonatal ward. The difference in the two groups was not statistically significant (P < 0.14).

- NO neonate had cord blood pH< 7.20 (suggesting absence of severe birth asphyxia).But there was significantly more number of neonates with pH on the lower limit of the normal range.

- There were no deaths in both study and control groups.

CONCLUSION

CONCLUSION

- An amniotic fluid index of < 5 cm detected after 37 completed weeks of gestation in a low risk pregnancy is an indicator of poor pregnancy outcome.
- In presence of oligohydramnios, the occurrence of non-reassuring NST, abnormal FHR tracings during labor, thick meconium stained liquor, development of fetal distress, the rate of LSCS, low 5 minute Apgar score, low birth weight and perinatal mortality were concluded to be higher by earlier studies.
- In our study the rate of LSCS, meconium stained liquor, non-reassuring NST, abnormal FHR tracing during labour, development fetal distress, lower neonatal birth weight and low normal value of cord blood pH was more in the oligohydramnios group when compared to the control group.
- Though there is a higher occurrence of poor maternal outcome, there was no statistically significant difference in the occurrence of adverse neonatal outcomes except for lower birth weight among neonates born to oligohydramnios mothers.
- Thus it can be concluded from this study that low AFI at term can be used as a predictor of poor maternal outcomes in the form of increased incidence of emergency LSCS.
- Cord blood pH can be used as a useful tool to determine birth asphyxia in newborn and hence predict long term sequelae like Intraventricular hemorrhage and Hypoxic ischemic encephalopathy.
- Determination of AFI can be used as an adjunct to other fetal surveillance methods.
- Determination of AFI is a valuable screening test in predicting fetal distress which might require caesarean section.
- But a fair trial of labour with continuous fetal and maternal monitoring can be done in women with isolated oligohydramnios.

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ANNEXURES

CASE PROFORMA

NAME: AGE: Yrs IP NO:

OCCUPATION: DOA:

ADDRESS: DOD:

EDUCATION:

HUSBANDS OCCUPATION:

SOCIOECONOMIC STATUS:

CHIEF COMPLAINTS:

HISTORY OF PRESENT ILLNESS:

OBSTETRIC HISTORY:

Marital life:

Consanguinity:

Obstetric formula:

Details of previous pregnancy:

Details of present pregnancy:

MENSTRUAL HISTORY

Last menstrual period: Age of menarche:

Expected delivery date:

Past menstrual cycles:

Period of gestation:

Period of gestation according to early scan:

PAST HISTORY:

HTN/DM/BA/RHD/TB/FEVER/BLOOD DYSCRASIAS/EPILEPSY

H/O blood transfusions:

Others: H/O Surgeries

PERSONAL HISTORY:

Sleep and appetite: Diet:

Bowel and bladder:

FAMILY HISTORY:

DRUG HISTORY:

GENERAL EXAMINATION:

General condition: Fair/ moderate/ Poor

GCS:

Built: Nourishment:

Ht: cms Wt: kgs BMI:

Pallor: Icterus: Cyanosis: Clubbing: Lymphadenopathy:

Pedal oedema:

VITALS:

Pulse rate:

Respiratory rate:

Blood pressure

Temperature:

SYSTEMIC EXAMINATION:

Cardiovascular system:

Respiratory system:

Central nervous system:

PER ABDOMEN:

PER VAGINUM:

PROVISIONAL DIAGNOSIS:

INVESTIGATIONS:

Blood group and Rh typing:

CBC: HB: RBS:

PCV HbsAG:

RBC VDRL:

WBC: HIV:

OBSTETRICS SCAN:

MODE OF DELIVERY:

INDICATION:

AUGMENTATION (IF DONE):

DELIVERY DETAILS:

Date: APGAR SCORE:

Time: I min:

Sex: 5 min:

Birth weight: Cord Blood pH:

MATERNAL COMPLICATIONS: FETAL COMPLICATIONS:

Asphyxia:

Hypotonia:

Need for neonatal resuscitation:

Admission to NICU:

Cord blood ABG:

Mother(General condition):

Baby:

PATIENT INFORMATION SHEET

Study title:A study of obstetric outcome in women with isolated oligohydramnios at term.

Study location: R L Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College.Tamaka, Kolar

Details-

Patients presenting between 37-42 weeks of gestation with singleton pregnancy and intact membranes will be taken up for the study.

Patients will be compared in the two groups –AFI < 5 cms and other with borderline AFI in terms of fetal and maternal outcomes.

Maternal morbidity in terms of need for caesarean section will be noted. Neonatal morbidity in terms of APGAR score at 1 min and 5 min, fetal distress, meconium aspiration, need for NICU admission will be analyzed and compared. Patients in this study will have to undergo routine blood investigations such as a complete blood count, blood serology and urine routine, USG to determine the AFI. To assess the fetal well-being cardiotocography will be done. Cord Blood ABG will be taken after the birth of the baby.

Please read the following information and discuss with your family members. You can ask any question regarding the study. If you agree to participate in the study we will collect information (as per proforma) from you or a person responsible for you or both. Relevant history will be taken. This information collected will be used only for dissertation and publication.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. This study has been reviewed by the Institutional Ethics Committee and you are free to contact the member of the Institutional Ethics Committee. There is no compulsion to agree to this study. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

For further information contact

Dr.Poonguzhali Liston (Post graduate)

Department of Obstetrics and Gynecology

SDUMC, Kolar

Patient information sheet (kannada)

ಅಧ್ಯಾನದಹೆಸರು-

ಕಂಪ್ಯಾರಟಿವ್ಸ್ಟಡೀಆಫ್ಅಬ್ಸ್ಟೆಟ್ರಿಕ್ಔಟ್ಕಮ್ಇನ್ಐಸೊಲೇಟೆಡ್ಒಳಿಗೋಹೈಡ್ರಾಮಿನೋಸ್ಟಿತ್ನಾರ್ಮಲ್ಅಮೀನೋಟಿಕ್ಫ್ಲೂಯಿಡ್ಇಂಡೆಕ್ಸ್ಅಟ್ಟರ್ಮ್

37 - 42 ವಾರದಲ್ಲಿಆಸ್ಪತ್ರೆದಾಕಲಾಗುವಎಲ್ಲಗರ್ಭಿಣಿಸ್ತ್ರೀಯರನ್ನುಈಅಧ್ಯಯನದಲ್ಲಿಒಳಪಡಿಸಲಾಗುವುದುಗರ್ಭಿಣಿಸ್ತ್ರೀಯರನ್ನು ಎರಡು ಗುಂಪುಗಳಾಗಿ ವಿಂಗಡಿಸಲಾಗುವುದು ಒಂದು ಮಗು ಸುತ್ತ ನೀರು 5 ಸೆ. ಮಿ. ಕಿಂತ ಕೆಳಗೆ , ಇನ್ನೊಂದೋ ಗುಂಪು ನಾರ್ಮಲ್ ನೀರು.

ತಾಯಿಯಆನಾರೋಗ್ಯವನ್ನುಸೀಛ್ಛೇರಿಯನ್ಆಪರೇಶನ್ಅಗತ್ಯದಮೇಲೆಗುರುತಿಸಲಾಗುವುದು.
ಮಗುವಿನಅನಾರೋಗ್ಯವನ್ನುಅಪಾಗರ್ಒಂದುಮತ್ತೆಐದುನಿಮಿಷದಲ್ಲಿಮಗುಸುಸ್ತುಮಗುವಿಗೆNICU
ಅಲ್ಲಿಇಡುವುದನ್ನುಹೋಲಿಸಿವಿಶ್ಲೇಷಿಸಲಾಗುವುದು.
ಈಅಧ್ಯಯನದಲ್ಲಿಎಲ್ಲಗರ್ಭಿಣಿತಾಯಿಗೆರುಟೀನ್ರಕ್ತಪರೀಕ್ಷೆಗೆಒಳಪಡಿಸಲಾಗುವುದುಹಾಗೂನಿಯಾನ್ಸ್ಕಂಗೆ(ಮಗುಮತ್ತುನೀರಿನಂಶನೋಡಲು) ಒಳಪಡಿಸಲಾಗುವುದುಮಗುವಿನಹೃದಯಬಡಿತನೋಡಲು, ಸಿ. ಟಿ. ಜೆಮಾಡಲಾಗುವುದು. ಮಗು ಡೆಲಿವರೀ ಬಳಿಕ ಏಬಿಜೆ ಮಾಡಲಾಗುವುದು .ಕೆಳಗಿನಮಾಹಿತಿಯನ್ನುಓದಲುಮತ್ತುನಿಮ್ಮಕುಟುಂಬಸದಸ್ಯರುಚರ್ಚಿಸಬೇಕುದಯವಿಟ್ಟು.ನೀವುಅಧ್ಯಯನಬಗ್ಗೆಯಾವುದೇಪ್ರಶ್ನೆಕೇಳಬಹುದು.
ನೀವುಅಧ್ಯಯನದಲ್ಲಿಭಾಗವಹಿಸಲುಒಪ್ಪಿದಲ್ಲಿನಾವುನೀವುಅಥವಾನೀವುಅಥವಾಎರಡೂನಿರ್ವಹಿಸುವವ್ಯಕ್ತಿರಿಂದ(Proformaಪ್ರಕಾರ) ಮಾಹಿತಿಸಂಗ್ರಹಿಸುತ್ತದೆ.ಸಂಬಂಧಿತಇತಿಹಾಸತೆಗೆದುಕೊಳ್ಳಲಾಗುವುದು.ಸಂಗ್ರಹಿಸಿದಈಮಾಹಿತಿಯನ್ನುಪ್ರೌಢಪ್ರಬಂಧದಲ್ಲಿಮತ್ತುಪ್ರಕಟಣೆಗೆಬಳಸಲಾಗುತ್ತದೆ.

ನೀವುಸಂಗ್ರಹಿಸಿದಎಲ್ಲಾಮಾಹಿತಿಯನ್ನುಗೌಪ್ಯವಾಗಿಇಡಲಾಗುತ್ತದೆಮತ್ತುಯಾವುದೇಹೊರಗಿನವರಬಹಿರಂಗಮಾಡಲಾಗುವುದಿಲ್ಲ.
ನಿಮ್ಮಗುರುತನ್ನುತೋರಿಸಲಾಗುವುದಿಲ್ಲ.
ಈಅಧ್ಯಯನವುನೈತಿಕಸಮಿತಿಯವಿಮರ್ಶೆಮತ್ತುನೀವುನೈತಿಕಸಮಿತಿಯಸದಸ್ಯಸಂಪರ್ಕಿಸಲುಉಚಿತ.
ಈಅಧ್ಯಯನದಲ್ಲಿಒಪ್ಪಿಕೊಳ್ಳಲುಯಾವುದೇಕಡ್ಡಾಯಇಲ್ಲ. ನೀವುಭಾಗವಹಿಸಲುಇಚ್ಛೆಸದಿದ್ದರೆನೀವುಪಡೆಯುತ್ತಾನೆರಕ್ಷಣೆಬದಲಾಗುವುದಿಲ್ಲ.
ನೀವು/ ಸೈನ್ನೀವುಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದಈಅಧ್ಯಯನದಲ್ಲಿಭಾಗವಹಿಸಲುಒಪ್ಪುತ್ತೀರಿಮಾತ್ರಹೆಬ್ಬೆಟ್ಟಿನಗುರುತುಒದಗಿಸುವಅಗತ್ಯವಿದೆ.

ಹೆಚ್ಚಿನಮಾಹಿತಿಗಾಗಿಸಂಪರ್ಕಕ್ಕೆ

ಡಾ. ಪೂಂಗುಳಲಿ

ಸ್ನಾತಕೋತ್ತರ

ಪ್ರಸೂತಿಮತ್ತುಸ್ತ್ರೀರೋಗಶಾಸ್ತ್ರಇಲಾಖೆ

* SDUMC, ಕೋಲಾರ

INFORMED CONSENT

Date:

Obstetrician:

I / We the attenders of the patient were told the condition of the patient and the need for therapeutic intervention. I/we the attenders of the patient agree to participate in the study. The nature and purpose of the study and its potential risks / benefits and expected duration of the study, and other relevant details of the study have been explained to me in detail in my own understandable language. I /we understand that my participation is voluntary and that I/we are free to withdraw at any time, without giving any reason, without my medical care or legal right being affected. I/ we give permission for these individuals to have access to patient records. And we hereby give consent to the treating doctors for pharmacological intervention and we do not claim any responsibility on to the treating doctors, staff or hospital for any maternal and fetal complications and patient condition.

Signature of patient /Attenders

Time:

ಪ್ಪಿಗೆಪತ್ರ/ ರೂಪ

ಮಾನ್ಯರೆ,

ನಾವುನಡೆಸಿತ್ತಿರುವಸಂಶೋಧನಾವಿಷಯವಾದ"ಕಂಪ್ಯಾರಟಿವ್ಸ್ ಡೀಆಫ್ಐಸೊಲೇಟೆಡ್ಒಳಿಗೋಹೈಡ್ರಾಮಿನೋಸ್ ವಿತ್ ನಾರ್ಮಲ್ ಅಮೀನಿಟಿಕ್ ಫ್ಲೂಯಿಡ್ ಇಂಡೆಕ್ಸ್ ಅಟ್ ಟರ್ಮ್ "ದಲ್ಲಿಭಾಗವಹಿಸಲುಅನುಮತಿಯನ್ನುಕೋರುತ್ತಿದೇವೆ.

ನಿಮ್ಮಭಾಗವಹಿಸುವಿಕೆಯಸಂಪೂರ್ಣವಾಗಿನಿಮ್ಮಇಚ್ಚಾನುಸಾರವಾಗಿದ್ದುಇದರಲ್ಲಿಬಗೆಗೆನಿಮ್ಮನಿರ್ಧಾರವುನಿಮ್ಮಮತ್ತುಆಸ್ಪತ್ರೆಯನ ಡುವಿರುವಸಂಬಂಧದಮೇಲೆಯಾವುದೇರೀತಿಯಪರಿಣಾಮವನ್ನುಬೀರುವುದಿಲ್ಲಮತ್ತುಭಾಗವಹಿಸಲುನಿಮ್ಮಒಪ್ಪಿಗೆಯಿದ್ದರೆಈಸಂ ಶೋಧನಾಕಾರ್ಯಕ್ರಮದಿಂದಯಾವುದೇಕ್ಷಣದಲ್ಲಿಹಿಂಜರಿಯಬಹುದಾದಅವಕಾಶಇರುತ್ತದೆ.

ಈಸಂಶೋಧನೆಯಿಂದಾಗಿನಿಮ್ಮದೇಹದಮೇಲೆಯಾವುದೇದುಷ್ಪರಿಣಾಮವಾಗುವುದಿಲ್ಲ.

ನಿಮ್ಮಭಾವಹಿಸುವಿಕೆಯಬಗೆಗೆಗೌಪಾತ್ಯಯನ್ನುಕಾಪಾಡಲಾಗುತ್ತದೆಹಾಗೂಮಾಹಿತಿಯಬಾರಿನಮ್ಮಸಂಶೋಧನಾತಂಡದವರಿಗೆ ಮಾತ್ರತಿಳಿದಿರುತ್ತೆದೆ.

ಇದರಬಗೆಗಿರುವಎಲ್ಲಾಅನುಮಾನಗಳನ್ನುಹಾಗೂಪ್ರಶ್ನೆಗಳ್ಳನ್ನುಯಾವುದೇನಿರ್ಭಂದವಿಲ್ಲದೆ,
ಯಾವುದೇಸಮಯದಲ್ಲಿನೀವುನಿಮ್ಮತಂಡದೊಂದಿಗೆಚರ್ಚಿಸಬಹುದು.

ಇದರಲ್ಲಿಭಾಗವಹಿಸಲುತಾವುಮನಸ್ಪೂರ್ಪಕವಗಿಇಚ್ಚೆವಿದ್ದರೆದಯವಿಟ್ಟುಇಲ್ಲಿಸಹಿಮಾಡಿ.

ಭಾಗವಹಿಸುವಮಹಿಳೆಯರಸಹಿ

ದಿನಾಂಕ:

ಸಾಕ್ಷಿಗಾರರಸಹಿ:

Key to Master chart

1. **Maternal Age :**

   1-18-20

   2-21-23

   3-24-26

   4-27-29

   5->=30

2. **Gravida:**

   1-gravida 1

   2-gravida 2

   3-gravida 3

   4-gravida 4

3. **Parity:**

   1-P0

   2-para1

   3-para2

   4-Para3

4. **Gestational age at time of presentation :**

   1-37 weeks to 37+6 days

   2-38 weeks to 38+6 days

   3-39 weeks to 39+6 days

   4-40 weeks to 40+days

   5-41 weeks to 41 weeks+6 days

5. **Admission NST:**

1-reactive

2-non-reactive

6. **NST patterns:**

1-reactive

2-early deceleration

3-variable deceleration

4-late deceleration

7. A**FI at admission:**

1-0-1.0

2-1.1-2.0

3-2.1-3.0

4-3.1-4.0

5-4.1-5.0

8. **onset of labour:**

1-spontaneous

2-induced

9. **Mode of delivery:**

1-Normal vaginal delivery

2-forceps

3-vacuum

4-LSCS

10. **Indication for ceaserean:**

1-fetal distress

2-meconium

3-non progression

11. Birth weight:

1->2.0-2.5kg

2->2.5-3.0

3->3.0-3.5

4->3.5

12. Apgar at 1 min:

1-5

2-6

3-7

13. Apgar at 5min:

1-7

2-8

3-9

14. NICU admission:

1-yes

2-No

15. Cord blood pH:

1-<7.20

2-7.20-7.24

3-7.5-7.8

Control sl no	ip no	Age	Gravida	Parity	Gest age	Admis NST	NST finds	AFI	onset of labour	mode of delivery	ind for caesarean	birth weight	apgar at 1 min	apgar at 5	NICU adm	Cord bld ph
1		4	4	3	1	1	1	3	1	1		4	4	3	2	3
2		1	1	1	5	1	1	2	1	3		3	4	3	2	3
3		2	1	2	2	1	1	2	1	1		2	4	3	2	3
4		2	2	2	2	1	1	2	1	1		1	4	3	2	3
5		3	2	2	4	1	1	2	2	1		2	4	3	2	3
6		1	1	1	5	1	1	1	2	4	2	2	3	1	1	2
7		2	3	3	4	1	1	2	2	1		1	4	3	2	3
8		5	2	2	2	1	1	2	1	1		2	4	3	2	3
9		2	2	2	4	1	1	2	1	1		1	4	3	2	3
10		1	1	1	5	2	2	2	1	4	1	2	2	2	1	2
11		2	1	1	4	1	1	2	2	3		3	4	3	2	3
12		3	2	2	2	1	1	2	1	3		3	4	3	2	3
13		2	1	1	3	1	1	2	1	2		2	4	3	2	3
14		1	3	2	1	1	1	2	1	1		2	4	3	2	3
15		2	2	2	4	1	1	2	2	1		1	4	3	2	3
16		3	2	2	3	1	1	1	1	1		2	4	3	2	3
17		2	1	1	5	2	3	2	2	4	1	2	4	3	2	3
18		1	2	2	3	1	1	2	1	1		2	4	3	2	3
19		3	2	2	4	1	1	2	2	1		1	4	3	2	3
20		2	1	1	4	1	1	2	2	3		3	3	3	2	3
21		2	2	2	2	1	1	2	1	1		1	4	3	2	3
22		2	1	1	3	1	1	2	1	3		2	4	3	2	3
23		1	1	1	4	1	1	2	2	2		2	4	3	2	3
24		3	2	2	4	1	1	2	1	1		1	4	3	2	3
25		2	1	1	3	1	1	2	1	1		2	4	3	2	3
26		2	1	1	4	1	1	2	2	4	3	2	4	3	2	3
27		1	1	1	5	1	1	2	2	3		2	4	3	2	3
28		4	2	2	4	1	1	2	1	1		1	4	3	2	3
29		1	2	2	2	1	1	2	1	1		2	4	3	2	3
30		2	1	1	4	1	1	2	2	1		2	4	3	2	3
31		3	1	1	3	1	1	2	1	1		1	4	3	2	3
32		2	2	2	4	1	1	2	1	3		2	4	3	2	3
33		3	1	1	1	1	1	2	1	3		2	4	3	2	3

34		1	1	1	4	1	1	2	2	1		1	4	3	2	3
35		1	2	2	3	1	1	2	1	1		2	4	3	2	3
36		2	1	1	4	1	1	2	2	1		1	4	3	2	3
37		2	1	1	4	1	1	2	2	1		2	4	3	2	3
38		3	2	2	3	1	1	2	1	1		2	4	3	2	3
39		3	1	1	4	1	1	2	2	3		2	4	3	2	3
40		4	1	1	4	1	1	3	1	1		1	4	3	2	3
41		3	2	2	2	1	1	2	1	1		2	4	3	2	3
42		3	3	2	1	1	1	2	1	1		2	4	3	2	3
43		3	1	1	4	1	1	2	2	1		1	4	3	2	3
44		3	1	1	3	1	1	2	1	3		2	4	3	2	3
45		3	1	1	4	1	1	2	2	1		1	4	3	2	3
46		3	2	2	4	1	1	2	1	1		1	4	3	2	3
47		4	2	2	3	1	1	2	1	1		2	4	3	2	3
48		3	3	2	4	1	1	2	1	1		2	4	3	2	3
49		3	2	2	4	1	1	2	1	1		2	4	3	2	3
50		3	2	2	3	1	1	2	1	1		2	4	3	2	3

case sl no	ip no	Age	gravida	parity	gest age	admis NST	NST finds	AFI	onset of labour	mode of delivery	nd for caesarea	birth weight	pgar at 1 m	apgar at 5	NICU adm	Cord bld ph
1	340566	1	1	1	1	1	1	5	1	2		3	4	3	2	3
2	335545	2	2	2	4	1	1	5	2	1		1	4	3	2	3
3	348075	3	1	1	2	2	4	1	1	4	1	1	2	1	1	2
4	348655	1	1	1	2	1	1	5	1	1		1	4	3	2	3
5	349698	1	1	1	1	1	1	2	2	4	2	2	3	2	1	2
6	349774	3	2	2	2	1	1	2	1	1		1	4	3	2	3
7	350532	1	1	1	4	1	1	5	2	1		1	4	3	2	3
8	351910	2	1	1	1	2	3	1	1	4	1	1	3	3	1	2
9	360363	3	2	2	2	1	1	3	2	1		1	4	3	2	3
10	360914	1	1	1	4	1	1	5	2	2		3	4	3	2	3
11	286916	3	3	2	2	1	1	3	2	4	3	2	4	3	2	3
12	329396	1	1	1	2	2	2	1	1	4	1	1	4	3	2	3
13	364750	2	1	1	1	1	1	3	1	1		1	4	3	2	2
14	365985	1	1	1	4	1	1	5	2	3		4	4	3	2	3
15	373582	2	1	1	4	1	1	5	2	1		1	4	3	2	3
16	373792	2	1	1	1	1	1	3	1	4	2	2	4	3	2	3
17	330287	1	1	1	5	1	1	5	2	1		1	4	3	2	2
18	325800	3	1	1	4	1	1	5	2	1		1	4	3	2	3
19	325808	1	1	1	1	2	3	1	1	4	1	2	3	2	1	2
20	331477	2	2	2	2	1	1	5	2	1		1	4	3	2	3
21	251290	1	1	1	4	1	1	3	2	1		1	4	3	2	3
22	290031	3	1	1	1	1	1	4	1	3		3	4	3	2	3
23	339748	2	2	2	3	1	1	5	2	1		1	4	3	2	3
24	342681	4	1	1	4	1	1	2	2	4	2	2	4	3	1	2
25	335540	3	1	1	1	2	3	1	1	4	1	2	3	2	1	2
26	284211	1	1	1	4	1	1	4	2	1		1	4	3	2	3
27	284101	2	1	1	3	1	1	5	2	1		1	4	3	2	3
28	286972	3	1	1	1	1	1	2	1	4	2	2	4	3	2	3
29	289030	3	3	2	2	1	1	5	2	1		1	4	3	2	3
30	299692	4	4	2	3	1	1	5	2	1		1	4	3	2	3
31	281024	5	3	2	2	1	1	5	2	1		1	4	3	2	3
32	279107	3	1	1	3	1	1	3	2	3		3	4	3	2	3
33	280414	2	1	1	1	2	3	2	1	4	1	4	4	3	2	3
34	292330	2	1	1	1	1	1	3	2	1		1	4	3	2	2
35	291337	4	4	3	2	2	3	2	1	4	1	2	4	3	2	3
36	288991	3	1	1	3	1	1	4	2	1		1	4	3	2	3
37	268063	3	2	2	4	1	1	5	1	1		1	4	3	2	3
38	159146	2	1	1	3	1	1	3	2	3		3	4	3	2	3
39	262297	3	2	2	2	1	1	2	2	4	3	2	4	3	2	3
40	255091	1	1	1	3	1	1	3	1	1		1	4	3	2	3
41	251292	4	4	4	2	1	1	3	2	1		1	4	3	2	2
42	251260	2	1	1	5	1	1	4	1	3		2	4	3	2	3
43	231235	5	4	4	2	2	3	2	1	4	1	2	4	3	2	3
44	284321	2	1	1	3	1	1	4	1	1		1	4	3	2	3
45	287038	3	2	2	1	1	1	2	2	4	3	3	4	3	2	3
46	281361	2	1	1	3	1	1	4	1	3		2	4	3	2	3
47	289089	5	4	3	1	1	1	2	2	1		1	4	3	2	2
48	292391	4	4	3	3	1	1	4	1	1		1	4	3	2	3
49	281468	3	2	2	4	1	1	4	2	1		1	4	3	2	3
50	282851	2	1	1	5	1	1	4	1	1		1	4	3	2	2