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THEME : IMPLEMENTATION OF EVIDENCE BASED CLINICAL CARE

MOTTO : SWEAT, SMILE & REPEAT

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TEAM AOGS MESSAGE

Dr. Jignesh Deliwala
President

Dr. Munjal Pandya
Hon. Secretary

Dear Members,

We will soon now step into a whole new calender year 2022!

Wishing you all a very Happy New Year!We recently had a very successful ICCOB 2021, which was actually executed after planning thrice over last one year, but couldn't get executed due to pandemic. Our own Dr. Alpesh Gandhi, Immediate Past President, FOGSI; had this vision of Presidential Conference held at Ahmedabad after decades! He, along with whole organizing team of ICCOB, of which Team AOGS and our AOGS Members, were an integral part, made it a huge academic and fun filled Extravaganza! Thank you so much AOGS Family for bringing this conference a huge name and fame to be remembered for long in the minds of FOGSIans!

We have made all the proceedings available on our AOGS YouTube channel for the greater good of society, do take advantage of 'one click away' academic treasure!

Wishing all Healthier and Happier times!

Thank you!

Dr. Jignesh Deliwala
President

Dr. Munjal Pandya
Hon. Secretary

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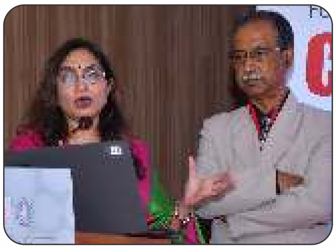

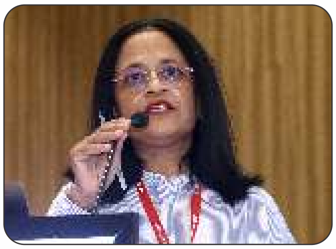







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A study of comparison of effectiveness of letrozole (5mg) versus clomiphene citrate (100 mg) for ovulation induction among infertile women

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1) Anovulatory dysfunction is a common problem and is responsible for about 40% of female infertility and among causes; PCOS (polycystic ovarian syndrome) is the leading cause.

2) Although Clomiphene citrate is considered as the first line treatment of anovulatory dysfunction for a variety of reasons, but has certain limitations like

- Multi-follicular development and cyst formation
- Peripheral anti-estrogenic effect Causes endometrial thinning
- Longer half-life of 5-7 days - Estrogen receptor (ER) deletion for longer duration
- High rates of resistance in PCOS
- Higher multiple pregnancy rate
- Thick cervical mucus
- Blocking estrogen receptors leads to hyperstimulation of ovaries
- Comparatively lower live birth rate -56 %
- Comparatively lower ovulation rate -78 %
- Comparatively higher miscarriage rate

Need of the hour is effective alternative therapy which minimize these all obstacle with minimum side effect profile – Letrozole 5 mg offers

- Mono-follicular ovulation
- No anti-estrogenic effect -Better endometrial thickness
- Short half-life, thereby it rapidly eliminated from body within 42 hours, with less risk of ovarian hyperstimulation.
- Better cervical mucus quality-Improved implantation
- Lower multiple pregnancy rate
- Effective in CC-resistant PCOS
- Offers significantly better endometrial response
- High live birth rate -72 %
- Higher ovulation rate – 84 %

Protocol applied:

The study included 100 women presented with anovulatory infertility.	
Letrozole group (50 patients)	**Clomiphene citrate group (50 patients)**
The patients were orally administered 5.0 mg/dayLetrozole starting between the 3rd to 5thdays of menstrual cycle for five consecutive days with Estradiol Valerate 4 mg on the 12th day of menstruation until 16thday of menstruation	The patients were orally administered 100 mg/dayClomiphene Citrate starting between the 3rdto 5th days ofmenstrual cycle for five consecutive days with Estradiol Valerate 4 mg on the 12th day of menstruation until 16thday of menstruation

1) Based on these offerings from Letrozole, American College of Obstetrics and Gynaecologists (2016) society has recommended letrozole - as 1st line therapy for Ovulation induction in patients with PCOS and BMI >30 because of increased live birth rate (LBR) compared to clomiphene citrate.

2) Australian National Health and Medical Research Council (NHMRC) guidelines has recommended (2015), letrozole, under caution, could be offered as pharmacological treatment for Ovulation induction in infertile anovulatory women with PCOS with no other infertility factors.

3) An aromatase inhibitor, letrozole, as compared toclomiphene, was associated with higher live-birth andovulation rates among infertile women. The results of thestudy demonstrated letrozole to be superior to clomiphenecitrate in the maintenance of endometrial thickness.

4) Clomiphene citrate has some drawbacks; including itsoverall poor efficacy (56% rate of live birth), a relativelyhigh multiple pregnancy rate, and an undesirable side effect profile which includes mood changes and hot flushes. The important public health goal is to develop the effective,simple, and safe treatments for infertility. Aromatase inhibitors, letrozole, which blocks estrogen synthesis, directly affect hypothalamic-pituitary-ovarian uterine function and theoretically might increase pregnancy rates. Potential advantages of letrozole over clomiphene citrate include a more physiological hormonal stimulation of endometrium, a lower multiple pregnancy rate through single-follicle recruitment, a better side effect profile with lesser vasomotor and mood symptoms, and greater rapid clearance, thus reducing chances of periconceptional exposure.

Reference:

Indian Journal of Obstetrics and Gynaecology Research 2021;8(4):1–6

Role of Doppler in management of Fetal Growth Restriction (FGR)

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Fetal Dopplers:

Usually, Fetal evaluation is done by looking blood flow in i) Umbilical artery (UA), ii) Middle Cerebral Artery (MCA), and iii) Ductus Venosus (DV) and calculation of RI, PI and Cerebro-Placental Ratio (CPR) is done for deciding appropriate time of delivery of a FGR fetus for better perinatal outcome. Improper placentation at maternal level including changes in the placental bed like atheromatous-like lesions that completely or partially occlude the spiral arteries are associated with FGR.[9]

Normally with the increasing gestational age the resistance in the umbilical artery reduces to improve the flow to the fetus for the increasing demands, growth and development. In FGR cases, one of the first pathological findings is increased impedance to flow in umbilical artery (UA) signified by increase in Umbilical artery resistance (RI) & pulsatility index (PI). This is usually associated with evidence of arterial redistribution in the fetal circulation, best monitored by examining the PI in the middle cerebral artery (MCA PI), which is decreased (known as Brain sparing effect), which ultimately results in the fall of Cerebro-Placental Ratio (CPR = MCA PI / UmbA PI) and subsequently results in pathological fetal heart rate patterns. The time interval between doppler changes and onset of late fetal heart rate decelerations is about two weeks.Hence these two umbilical artery PI and cerebro-placental ratio (CPR) are considered as most useful diagnostic criteria for FGR.[10]

Normal doppler of venous circulation states fetal compensation, with persistent hypoxia as there is breakdown of this compensatory mechanism, changes in venous doppler starts appearing.

Umbilical artery (UA) Doppler

Umbilical artery is the most important & easiest vessel to be looked with Doppler and was first described by Fitzgerald in 1970s. In uncomplicated pregnancies, the umbilical artery shows good diastolic flows with decreasing impedance with advancing gestation. As it originates from placenta, Umbilical artery Doppler characteristics defines the placental compromise.

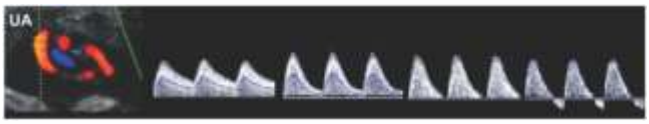
In FGR cases due to abnormal placentation the vessels lining remain thick and sensitive to the vasoconstrictors therefore, the resistance of the vessels slowly increases finally progressing to absent end diastolic velocity (AEDV) flows and even reversal of end diastolic velocity (REDV). This increased impedance and reduced blood flow is responsible for low birth weight, pH at birth, Apgar score and increased morbidity. The AEDV waveformis marker of FGR increased risk of fetal acidosis and perinatal death.

Umbilical artery doppler screening has not been found useful as a predictor forFGR / complications in low-risk pregnancies (Newnham J.P. 1990) but useful as a predictor of adverse outcome and admission to NICU after 34 weeks in high-risk cases like FGR. Umbilical artery Doppler velocimetry has been evaluated extensively in randomized controlled trials and the Cochrane meta-analysis (Neilson J.P 1996) which concluded that among high-risk patients, Doppler was helpful in deciding time of delivery thus reducing perinatal mortality.

For UA doppler it is important to Use B-Mode initially to identify the umbilical cord at fetal insertion or any free loop. Use color Doppler and spectral Doppler to sample the umbilical artery with 2 mm sample gate. Signals are recorded for a minimum of 3-5 waveforms of equal shape and amplitude and fixed. Machine itself measures the end-diastolic velocity, RI, PI and S/D ratio.Repeat measurements in other free loops be done to confirm reduced, absent or reversed end diastolic flows, after decreasing wall filters further and using angle correction.

The transition from AEDF to REDF is slow and gradual mostly in early FGR. AEDV in the umbilical artery can last for days before REDF and abnormal heart rate patterns seen on NST or cCTG. REDF is associated with perinatal mortality in 50% cases and significant morbidity and neuro developmental delay.

- Umbilical artery Doppler flow pattern



Umbilical artery doppler	Normal flow: Low resistance flow	High resistance flow	Absent diastolic flow AEDV	Reverse end diastolic flow: REDF

Middle cerebral artery (MCA) Doppler

Cerebral circulation has been extensively worked up in the high-risk pregnancies. Middle cerebral artery (MCA) Doppler imaging has been the chosen in clinical practice, as it is easy to image, and its reproducibility and repeatability have been well established. Proximal region of MCA should be chosen rather than mid or distal region for doppler, as the proximal area is supposedly less influenced by behavioral patterns.

In fetus the MCA normally has high resistance flow in second trimester. It has been reported that there is decrease in the impedance after 30 weeks of gestation [Mari, G 1992, Veille, J.C. 1993]probably due to increased oxygen demands in the 3rd trimester [Mari, G 1992]. The fetus at risk for hypoxia preserves the oxygen supply to its brain by increasing blood flow; a phenomenon called 'brain sparing' first described by Saling in 1966. In FGR cases there is redistribution of cardiac output in favor of the critical organs such as the heart, brain, and adrenals by vasodilation, appearing as increase in diastolic flow and reduction in PI in the MCA.

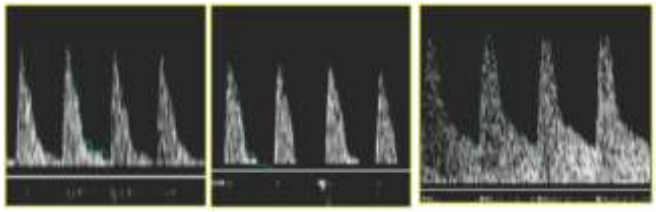
Brain sparing persists till the fetus is able to compensate, later with persistent hypoxia it become too compromised to compensate any longer, the brain sparing disappears, followed by diminishing of the increased diastolic flow, progressing to high resistance flows, absent and then reverse diastolic flows, usually associated with abnormalities in the CTG tracing, which could be an ominous sign for impending fetal demise. Brain sparing is brought about by auto regulation with the help of baroreceptors and chemoreceptors in regional circulation. In a compromised fetus, changes in MCA start with an increase in EDV, followed by a reduction in MCA RI and PI, and with progressive fetal compromise, the peak systolic velocities also increase in FGR. In late stages loss of autoregulation, associated with cerebral edema, cause the RI and PI to rise again;(pseudo-normalization' of RI and PI)which could be a preterminal event.Forouzan et al reported that MCA flows become abnormal earlier than other parameters such as the BPP, NST, or contraction stress tests (CST), used to monitor the status of the growth-restricted fetus.

'Brain sparing' was defined as MCA PI more than 2 SD below the gestational age mean, 'centralization' was defined as the ratio of MCA /UA -PI i.e, cerebroplacental ratio more than two 2 SD below the gestational age mean, and 'redistribution' was absent or reversed UA - EDV. They found IVH being associated with absent/reversed EDV in the umbilical artery of the FGR fetus. Brain sparing is a protective mechanism to reduce the severity of brain injury in FGR cases.

Cerebral vasodilatation although easily appreciable by reduction in the PI of MCA in response to hypoxia is currently not included in diagnostic protocol for the management of early FGR below 32 weeks fetuses as insufficient data exists in prospective studies to define its role.

Several studies have reported that ratio of indices of MCA and UA beperformed to compare cerebral and placental resistance to identify compromise &hemodynamic consequences early.

Figure – 2 : Middle Cerebral artery Doppler



Normal flow in MCA

Low resistance flow in MCA suggesting redistribution.

Cerebroplacental ratio (CPR)

CPR has been constructed using the ratio of MCA to UA PI. It has the potential advantage of evaluation of increasing placental resistance as well as the redistribution of cerebral flows with MCA Doppler flow waveforms and closely defines the pO2 changes.

Fetal hemodynamics, detecting fetal adaptation and compromise is better with CPR compared with UA or MCA doppler alone especially in late FGR, even when umbilical flows are in the normal range.CPR values below the 5th centile for gestational age, has been considered a good predictor of adverse perinatal outcomes in growth-restricted fetuses. Roughly CPR <1.2 at GA less than 35 weeks and 1 or less than 1at more than 35 weeks is abnormal. Abnormal fetoplacental flow and CPR have not only shown to correlate with higher mortality and morbidity but also abnormal cognitive development in an age range of 3 to 6 years.

As shown in the above figure, when there is vasodilatation in cerebral vessels due to fetal hypoxia, the blood from ascending aorta increases towards brain and additional flow increases from aotic isthmus, showing decreased flow in aortic isthmus.

Aortic Isthmus Doppler

The aortic isthmus is the segment of aorta located between the origin of the left subclavian artery and the connection of the ductus arteriosus to the descending aorta.

: Aortic isthmus- white part-common place between right and left ventricular circulation.

Measurements on Aortic Isthmus flow is to be done by **PI or IFI (Integral flow index= S+D/S)**

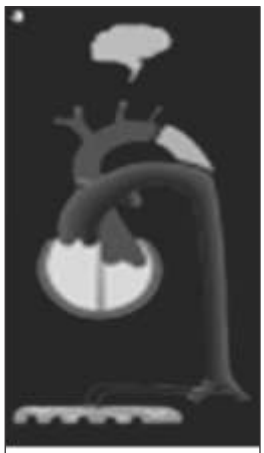


Figure 3:- Aortic isthmus-white part- common place between right and left ventricular circulation.

- More than1 IFI is fine when the flow is antegrade both at systole and diastole.
- 0-1 IFI is an equivocal situation when there is reversal of diastolic flow but predominantly antegrade in systole..
- Negative/ <0 is problematic when flow is mainly retrograde.

As shown in the above figure, when there is increase in vasodilatation in cerebral vessels due to persistent fetal hypoxia, the blood from ascending aorta still increases towards brain and additional flow is diverted from right

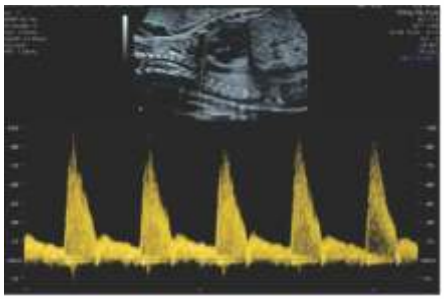


Figure 4 - Normal Aortic Isthmus identification and doppler

ventricular output via ductus arteriosus and aortic isthmus, showing reversal of flow in aortic isthmus blood flows towards brain.

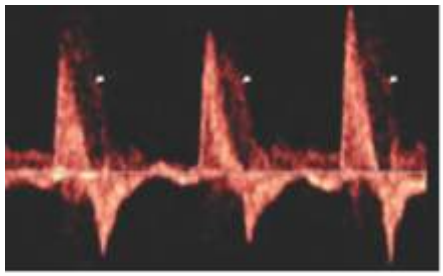


Figure 5 - Abnormal flow in Aortic isthmus. Please note that reversal of flow in diastole.

Ductus Venosus (DV) Doppler

DV reflects volume status of Right atrium of the fetus in responsive to fetal oxygenation. RA

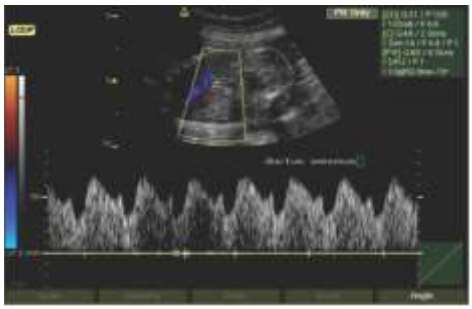


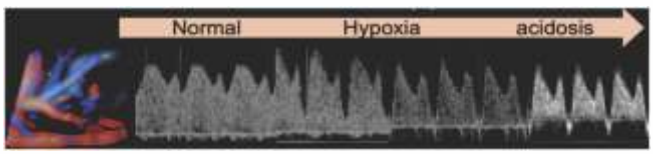
Figure 6:- Normal flow in ductus venosus

Dilates as fetal hypoxia worsens therefore in severe hypoxia –reversal of (a) wave due to atrial contraction is notified suggests decompensating heart due to increase in severe after load.

In reversed 'a' wave in DV or Serial increased PI in DV needs immediate delivery of fetus. There might be onset of premature CNS insult, which does not give time for steroid support also.

Ductus venosus is seen as a small vessel running form portal sinus to junction of inferior vena cava at the level of intrahepatic portion of the umbilical vein. It is identified by its high velocity flow and color turbulence. It can be seen in its full length in a mid-sagittal longitudinal section of the fetal trunk.

- Ductus Venosus doppler, normal to abnormal flow - Progression of hypoxic sequence



NORMAL FLOW – 95CENTILE – NO FORWARD FLOW – REVERSAL WAVE

Figure 7- Ductus Venosus doppler, normal to abnormal flow.

The follow up of any patient should be as mentioned above, having about 4 scans in the gestation. This would help us in early prediction and proper management of FGR.

Uterine artery doppler:

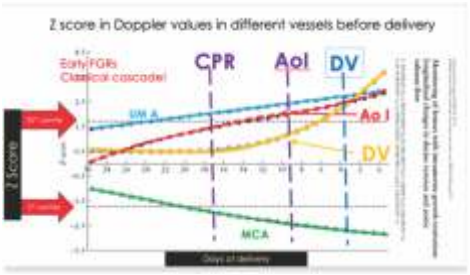
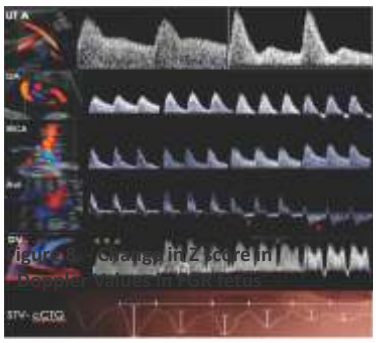


Figure 8 - Change in Z score in Doppler Values in FGR fetus

When uterine arteries fail to transform from high- to low-resistance circulation due to inadequate trophoblastic invasion of the spiral arteries, this is reflected as a persistence of high uterine artery mean pulsatility index (PI) (above the 95th percentile) and is associated with placental insufficiency and maternal vascular malperfusion of the placenta. Z score given from 5th to 95th percentile. (Fig- 11)

COMPREHENSIVE STRATEGY FOR MONITORING &DELIVERY DECISION 13



A combination of these surveillance modalities is needed to determine the fetal acid base status at the time of testing and anticipate future deterioration. In an ideal setup, computerized CTG and doppler should be used for antepartum fetal monitoring and scalp pH and ABG analysis can be used for intrapartum monitoring for fetal hypoxia and acidosis.

Various options are given for delivery decision of FGR fetus, as the management depends upon resources and services available at the institution.13

Table -5: Doppler based Monitoring & Delivery plan of FGR (FOGSI) 14,15

AEDF: Absent End Diastolic Flow; REDF: Reversed End Diastolic Flow

Various triggers for delivery can be as under-

Conclusion

Fetal Growth Restriction is affecting about 5-11 % of all fetuses which is associated with increased perinatal morbidity and mortality. Timely antenatal care with ultrasound and feto-maternal doppler at 11-14 weeks, 18-23 weeks , 30-32 weeks and at 36-37would help in predicting and managing FGR fetuses. Timely intervention can reduce fetal compromise and in turn decreases fetal hypoxic events leading to decreased perinatal morbidity and mortality.

Doppler velocimetry is the key for early detection, prompt follow up, and timely decision making in management of FGR. Uteroplacental circulation helps in identifyinghigh risk cases for FGR. Fetal doppler of UA, MCA, DV & UtA in such high risk for fetal adaption to fetal hypoxia (brain spearing effect). Doppler with cCTG helps indeciding time of delivery.

Factors influences the decision of timing of delivery are gestational age, early or late FGR, doppler findings of UtA, UA, MCA, DV and cCTG (if available). Appropriate use of steroids and MgSO4 will improve the neonatal outcome. Abnormal ductus venosus Doppler (a wave) signifies impending severe fetal hypoxia with acidosis and be considered for urgent intervention.

: Doppler based Monitoring & Delivery plan of FGR (FOGSI)

Category	Risk of stillbirth	Monitoring	Timing and mode of delivery
SGA (EFW at 3rd –10th percentile, normal fluid, and Doppler studies) **Uncomplicated FGR**(EFW<3rd Percentile or fall of AC/EFW by 2 SD, normal liquor & normal Doppler)	Low	Growth scan with doppler every 2 weeks Doppler (UA, MCA) every 1–2 weeks BPP/NST once a week At ≥37 weeks consider BPP/NST 1–2 times per week.	· 37–39 weeks · MOD: Induction 37–38 weeks · MOD: Induction
FGR with mild abnormalities: Early Doppler changes: UA PI > 95th percentile, or MCA PI < 5th percentile, CPR <5th percentile, Ut.A PI >95th percentile or Oligohydramnios Suboptimal interval growth	Low	Consider inpatient monitoring, especially if other co-morbidities ˜ Consider steroids for fetal lung maturation if at risk of prematurity ˜ BPP/NST 2 times per week ˜ Doppler (UtA, UA, MCA, DV) 2 times per week ˜ Growth scan every 2 weeks	34 –37 weeks · MOD: Caesarean section or induction with continuous CTG
FGR with umbilical artery AEDF/REDF **Absent end diastolic flow** **Reversal of end diastolic flow**	Moderate	Inpatient monitoring Steroids for fetal lung maturation Consider MgSO4 if gestation is below 32 wks BPP/NST 1–2 times per day Doppler (UA, MCA, DV) every1–2 days	AEDF: 32–34 weeks · REDF: 30–32 weeks · MOD: Caesarean section
FGR with abnormal ductus venosus Doppler - Absent or reversed "a" wave	High	plan termination of pregnancy -C-section Steroids for fetal lung maturation Consider MgSO4 if gestation is below 32 weeks	26 –30 weeks · MOD: Caesarean delivery

Table – 6:Triggers for delivery based on availability of cCTG

if cCTG is available		**if CCTG is not available**	
Early FGR (<32 weeks)	**Early FGR (<32 weeks)**	**Early FGR (<32 weeks) FGR**	**Late FGR (>32 weeks) FGR**
1. DV above 95th centile 2. AEDV/ REDF in UA 3. cCTG STV < 3.00 ms 4. Maternal condition 5. Altered BPPS <4 6. Unprovoked repeated decelerations	1. MCA PI >95th centile 2. CPR <5th centile 3. DV above 95th centile 4. AEDV/ REDF in UA 5. cCTG STV < 4.5 ms 6. Maternal condition 7. Unprovoked repeated decelerations	1. DV above 95th centile 2. AEDV/ REDF in UA	1. MCA PI >95th centile 2. CPR <5th centile 3. DV above 95th centile 4. AEDV/ REDF in UA

APPPENDICITIS IN PREGNANCY

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The pregnancy is the state of altered normal physiology. The pregnant patient represent the complex clinical challenge. Common and serious conditions that develop during pregnancy requires prompt diagnosis and treatment to avoid the high morbidity and mortality associated with it. This is because the abdominal signs of peritoneal irritation are subdued in pregnancy due to the immunosuppression of pregnancy and clinical examination is difficult because of enlarged uterus.[1]

- **OBJECTIVES**

1. Describe the typical and atypical presentation of appendicitis in pregnancy
2. Summarize the management of pregnant patient with appendicitis
3. Review the common complication of appendicitis during pregnancy and their management
4. Review the fetal outcome in case of appendicitis with pregnancy

- **INTRODUCTION**

Appendicitis is the most common surgical problem in pregnancy followed by cholecystitis. It is most common non obstetrics cause of abdominal pain in pregnancy. The frequency of appendicitis in pregnancy is 1 in 1500 to 1700 pregnancy[2,3]. Its diagnosis represents a challenge as its classical clinical presentation is not always present, its common symptoms are nonspecific and often associated with normal pregnancy and the gravid state may mask the clinical picture.

Also the obstetric causes may obscure the diagnosis and physical examination of pregnant patient may be difficult due to gravid uterus and its effect its effect on displacing the appendix within the abdomen. Furthermore biochemical and laboratory indicators used to support the diagnosis of appendicitis may be unreliable during pregnancy[4].

- **ETIOLOGY**

Appendicitis is caused by luminal obstruction. Obstruction of proximal lumen of appendix leads to elevated pressure in distal portion because of ongoing mucus secretion and gas production by bacteria within the lumen. With the progressive distention of the appendix, the venous drainage become impaired resulting in mucosal ischemia. With continued obstruction, full thickness ischemia ensues which leads to perforation. Perforation result in diffuse peritonitis[5].

Infections associated with appendicitis is polymicrobial. Most common organism are Escherichia coli, Bacteroidfragilis, Enterococci and Pseudomonas aeruginosa[6].

The cause of luminal obstruction include fecal stasis, fecoliths , lymphoid hyperplasia, neoplasm, fruits and vegetable material, ingested barium and parasites.

- **CLINICAL FEATURES**

In pregnancy appendicitis has a typical presentation in 50-60% of cases. The common symptoms of appendicitis like nausea and vomiting are nonspecific in pregnancyandare often associated with normal pregnancy. Lower quadrant pain in second trimester also known as round ligament pain further complicates the clinical picture because 50% of appendicitis occur during second trimester[7].

During pregnancy the appendix is displaced upward and laterally as the uterus enlarges. At times it may reach right flank. However pain in the right lower quadrant of abdomen remain the cardinal features of appendicitis in pregnancy[8]. Cervical motion tenderness may be present in the case of appendicitis because of irritation of the pelvic organs from the adjacent inflammatory process.

- **DIAGNOSIS**

Diagnosis of appendicitis by biochemical and laboratory finding is difficult. There is leukocytosis in case of appendicitis. However leukocytosis is normal in pregnancy. Similarly there is rise in C- reactive protein in appendicitis, However its level are physiologically elevated in pregnancy. Moreover the clinical feature also coincide with the obstetric emergency such as placental abruption, uterine rupture and preterm labour.

To overcome the difficulty in diagnosis various imaging methods like ultrasound and MRI are used. The initial study of choice is ultrasound with graded compression. It has advantage of being easily available, sage and inexpensive. In addition it also provide the information about fetal wellbeing and other obstetrics cause such as placental abruption. However the ultrasound must be done in left posterior oblique or left lateral decubitus instead of supine position as chances visualization of appendix increase in that position. The inflamed appendix is typically enlarged, immobile and noncompressible as visualized on ultrasound [9]. The sensitivity of ultrasound is 78 to 83% and specificity is 83 to 93%.

If the ultrasound finding are equivocal, MRI without gadolinium contrast with its excellent soft tissue contract resolution and lack of ionizing radiation remain the safe alternative for confirmation or exclusion of appendicitis in pregnancy. Criteria for MRI diagnosis include appendiceal enlargement >7mm, thickening >2mm and the presence of inflammation. The sensitivity of MRI is 100% and specificity is 98%. However the drawbacks of MRI are higher cost, motion artifact and limited availability [10]. However delay in diagnosis result in appendiceal perforation which increases the changes of maternal and fetal mortality.

- **DIFFERENCIAL DIAGNOSIS**

Appendicitis is most common non surgical cause of abdominal pain in pregnancy. However there are many obstetrical condition which interferes with the diagnosis of appendicitis. They are preterm labour, uterine rupture, placental abruption, torsion of right adnexal mass, red degeneration of fibroid and ectopic pregnancy[11].

- **MANAGEMENT**

The treatment for appendicitis in pregnancy is surgery at an earliest. Because the delay in treatment cause perforation followed by peritonitis which increase the risk of perinatal and maternal mortality. The choice of laparoscopicversus open technique for appendectomy in pregnancy is a point of discussion. Laparoscopy which was earlier contraindicated in pregnancy is now considered standard procedure to many operation in pregnancy. Current Society of American Gastrointestinal and Endoscopic Surgeons guidelines state that laparoscopic appendectomy is safe in pregnancy and is standard of care in pregnancy [12].

The guideline for laparoscopic appendectomy in pregnancy are as follows[13]

1. Laparoscopy can be safely performed during any trimester of pregnancy.
2. Gravid patient should be placed in the left lateral decubitus position to minimize compression of the vena cava
3. Initial abdominal access can be safely accomplished with an open (Hasson) technique or optical trocar if the location is adjusted according to the fundal height and previous incisions.
4. CO_2 insufflation of 10-15 mm Hg can be safely used in laparoscopy in pregnant patient.
5. Intraoperative CO_2 monitoring by capnography should be used during laparoscopy in pregnant patient.
6. Intraoperative and postoperative pneumatic compression devices and early postoperative ambulation are recommended proplylaxis for deep venous thrombosis in pregnant women.
7. Trocar placement early in the pregnancy is same as in non pregnant patient. However later in the pregnancy the camera port should be in supraumbilical location and remaining port are placed under direct camera visualization.

Major concern of laproscopy during pregnancy are injury to gravid uterus, decreased uterine blood flow, fetal acidosis,pretermlabour due to increased intra abdominal pressure and decreased visualization with gravid uterus. However the advantage are decrease fetal depression secondary to decrease narcotic requirement, lower rates of wound infection and incisional hernia, decrease postoperative maternal hypoventilation, decrease manipulation of uterus, decrease chances of ileus and faster recovery.

In case laparoscopy is contraindicated the laparotomy should be done. In laparotomy muscle splitting incision is kept at the point of maximum tenderness. Uterinemanupilation is avoided due to risk of preterm labour[14].

During pregnancy exposure to anesthesia should be avoided till possible due to effect on mother and fetus. Therefore elective procedure should be be postponed till 6 weeks postpartum. However in case of emergency the life of mother takes the priority though the anesthesia administered should be altered for optimized fetal wellbeing.

Appendectomy should be avoided in first trimester is possible because of increase risk of damage to fetus. However if emergency it can be done. Second trimester is considered safe for laparoscopic appendectomy [15].

During the surgery in first trimester and early second trimester fetal heart rate monitoring should be obtained before and after anesthesia exposure. During late second and third trimester when fetus is of viable age continues intraoperative fetal monitoring should be performed with electric fetal monitoring, fetal pulse oxymeter or transvaginal ultrasound[16].

- **PRETERM LABOUR AND APPEDECTOMY**

The incidence of preterm labor associated with appendectomy is related to gestational age. The risk of preterm labor is higher in the late gestation.Laproscopic and open technique have equal incidence of preterm labor.

During surgery, measures to avoid maternal hypotension and hypoxia are thought to mitigate against preterm labor. The risk of preterm labour is 11% with complicate pregnancy and 6% with uncomplicated pregnancy.Tocolytics are used only if contraction are present postoperative period or felt by patient. Terbutaline, magnesium sulphate and indomethacin are the tocolytics most commonly used. For preterm contraction before 32 weeks indomethacin is preferred and for contraction after 32 weeks terbulatine is preferred[17].

- **FETAL OUTCOME**

The impact of appendicitis on pregnant patient is severe. The risk of fetal loss is 6% with complicated appendicitis and 2% with uncomplicated appendicitis[12].

- **MATERNAL OUTCOME**

Maternal outcome is better if appendicitis is operated without delay. If there is delay in treatment there are chances of peritonitis which increase the risk of maternal and perinatal mortality.

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