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Editorial

Interventional Ultrasound in Obstetrics - A Modern Perspective

Adi E. Dastur

Introduction

Interventional ultrasonography (USG) has revolutionalised the field of prenatal diagnosis & care. Using the USG machine one can carry out various invasive procedures for diagnosis and therapy. Color Doppler helps further making these procedures minimally invasive but maximally productive.

Interventional Procedures

The following invasive procedures can be carried out on the embryo/fetus.

- Chorion Villus Sampling
- Amniocentesis
- Cordocentesis
- Fetal tissue biopsies
- Placental biopsy
- Multi fetal pregnancy reduction / Selective Termination.

CHORION VILLUS SAMPLING (CVS)

Chorion frondosum is sampled by needle aspiration or by catheter as an alternative to amniocentesis or cordocentesis for prenatal diagnosis in the first trimester.

Indications

- Maternal-age related aneuploidy risk.
- History of previous child with aneuploidy
- Risk for Monogenic Disorder
- Parental Chromosome rearrangement.
- Pregnancies at risk for X-linked disorders / Autosomal Recessive disorders.

Types of Technique

- Transcervical
- Transabdominal

Transcervical

A Flexible Polyethylene catheter with a metal obturator or an angled metal aspirator is introduced through the cervix and guided with the help of USG till the Chorion Frondosum is reached. A syring containing medium is attached to the catheter and about 10-50 mg of tissue are aspirated out. This approach is generally employed till 12 weeks.

Transabdominal

It was first developed in Denmark by Smid-Jensen and Hahnemann. It can be done as a freehand or USG guided procedure using a needle aspiration method. Placental trauma is minimal if unintended lateral movements are reduced. The aspirated tissue is carefully separated using dissection microscope.

Complications

Procedure related :

1. **Miscarriage :**
   Various studies worldwide have shown a miscarriage rate of 2.4-6.2%. It carries the same risk as that of amniocentesis in experienced hands and when performed at comparable gestations. The rate is higher if transcervical route is used.

Limb reduction defects

These are usually transverse limb defects and are seen if the procedure is carried out prior to 9 weeks

gestation. The risk decreases with advancing gestational age

Diagnosis Related

1. Maternal cell contamination of culture.
2. Mosaicism and other placental variants (1%)

Advantage

The main advantage of CVS is the rapidity of the result. However, not all genetic labs have the ability to produce high quality direct preparations Nevertheless, even in those centers where a culture may be awaited before giving a result. CVS is preferred to amniocentesis, which seems to have a higher miscarriage rate.

AMNIOCENTESIS

Amniocentesis is the removal of fluid containing fetal cells and biochemical products from the amniotic cavity. It is the most common invasive, prenatal diagnostic procedure performed under USG guidance.

Indications

A. Prenatal Diagnosis

- Chromosomal Analysis (FISH/karyotype)
- DNA diagnosis (Single gene disorders – sickle: Fetal Blood Groups - Rh, Kell; Gene Dosage eg, aneuploidy);
- Biochemistry (AFP and acetyl cholinesterase)
- Fetal infection (Toxo, CMV – PCR, culture)

B. Fetal welfare

- Rh disease Alloimmunization
- Lung maturity
- Chorioamnionitis
- Obstetric Cholestasis

C. Fetal Therapy

- Hydramnios and Oligohydramnios (Amnio infusion)
- Multifetal pregnancy reduction
- Hypothyroidism.

Types

- Conventional Amniocentesis (16-18 wks)
- Early Amniocentesis (12-14 wks)

Methodology

- USG Guidance
- Transabdominal approach
- Strict asepsis
- 22 guage 7-10 cm spinal needle.
- A suitable pool chosen, after avoiding fetus placenta & cord
- Free-hand/Transducer Attached Technique.
- 15 ml Fluid to be aspirated

Complications

- Fetal Loss (2.5-3.5%)
- Preterm Labour / Delivery (3.7%)
- Respiratory Distress (1.1%)
- Postural deformities (1.7%)
- Fetal Trauma (0.2-0.5%)
- Alloimmunisation (1.5-2.5%)

CORDOCENTESIS :

Indications :

Diagnostic

- Chromosomal abnormalities
- DNA abnormalities
- Single gene defects
- Fetal Anaemia
- Fetal Thrombocytopenia
- Fetal Hypoxia Acidosis
- Fetal Infection

Therapeutic

- Fetal Anaemia
- Fetal Thrombocytopenia
- Fetal drug therapy

Methodology :

Sampling Site :

- Umbilical cord vessels cordocentesis
- Fetal Heart
- Intrahepatic Vessels

Needling

- Needle Guide
- Free-hand

Operator

- Single
- Double

Quantity of Blood Collected :

- <20 wks – 1ml.
- >20 wks – upto 5 ml.

Fetal Paralysis

- using IM Pancuronium
- onset is rapid
- duration is 90-120 min.

Post Procedure

- Look for bleeding using USG
- Check FHR

- Patient kept in hospital for a few hours
- CTG prior to Discharge
- NSAIDS for Pain Relief
- Anti D Prophylaxis.

Complications

Fetal :

- Bleeding Haematoma at puncture Site
- Fetal Bradycardia (due to umbilical artery vasospasm)
- Chorioamnionitis
- PROM
- Placental Abruption
- Preterm Delivery (1.5-7%)
- Miscarriage (1.5-2.5%)
- Death (0.1%)

Maternal

- Alloimmunization
- Chorioamnionitis
- Maternal Organ trauma (intestines / vessels)
- Emergency LSCS

Summary

Fetal Blood sampling is indicated when a judgement of the potential benefits of a change in management based on the result outweigh the procedure related risks. This includes a balance between the risks and benefits to both fetus and mother. Cordocentesis should be performed by experienced operators. The indication for sampling is the most important determinant for observed fetal loss rate.

FETAL TISSUE BIOPSIES

Fetal tissue biopsies may be performed either fetoscopically or under USG guidance for obtaining specific fetal tissue like fetal skin liver & muscle in order to diagnose rare fetal disorders.

The risk of pregnancy wastage is relatively high. Biopsies are obtained only when the yield exceeds the risks. Because of their rarity and the complexity involved in the analysis of specimens, these procedures should be performed only in specialized centres.

PLACENTAL BIOPSY

Placental Biopsy is an acceptably safe alternative to either amniocentesis or cordocentesis from the late first trimester onwards.

Since culture is avoided, a placental biopsy specimen shortens the time necessary for the diagnosis of monogenic disorders which require sizeable amount of DNA.

It may be performed either transvaginally upto 13 weeks or transabdominally throughout gestation.

The most common indication for placental biopsy is to rule out karyotypic abnormality.

True Mosaicism is observed in 1% samples most are confined to the placenta and / or the chorion. Any abnormality observed on the direct preparation should be confirmed by a culture.

CONCLUSION

Antenatal Diagnostic techniques have developed along two major directions. The first is the visualization of fetal structure and the second is the laboratory study of fetal tissue

The combination of cytogenetic, biochemical and molecular analysis in conjunction with high resolution USG guidance have helped enormously in the prenatal diagnosis of multiple fetal defects and diseases.

Dr. Adi. E. Dastur