# ANESTHESIA FOR FETAL SURGERY

Essay

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*Of Master Degree in Anesthesiology*

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# المعالجة التخديرية لجراحة الأجنة

رسالة

توطئة للحصول علي درجة الماجستير في التخدير

مقدمة من

الطبيبة /علياء علي مصلحي حسن
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# SUMMARY

Anesthesia for fetal surgery is becoming an exciting new area of practice for anesthesiologists. By constantly refining anesthetic techniques and readdressing important issues such as tocolysis, the anesthesiologist can not only play a vital role in the care of fetal surgery patients today, but also help to establish improvements in care and research in these patients for years to come.

Anesthesia for fetal surgery involves two patients simultaneously, the mother and the fetus. Anesthesia for fetal surgery differs from that for maternal surgery (e.g. Caesarean sections, cholecystectomy in the parturient) and fetal therapy (e.g. amniotic fluid reduction).

In fetal surgery, the fetus and mother are both active recipients of surgery whereas, in maternal surgery, the mother is an active recipient while the fetus is a bystander. In fetal therapy, the mother is a bystander while the fetus is an active recipient of therapy. The distinction will likely become more important as the mechanism of labour becomes better understood. Fetal surgery consists of open or minimally invasive procedures. Open procedures require a hysterotomy on the mother and major airway, thoracic, cardiovascular and neurological procedures on the fetus. Minimally invasive fetal procedures include insertion of

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بسم الله الرحمن الرحيم
وَأَنْزَلَ اللهُ
عَلَيْكَ الْكِتَابَ
والْحِكْمَةَ
وَعَلَّمَكَ مَا لَمْ
تَكُنْ تَعْلَمُ
وَكَانَ فَضْلُ
اللهِ عَلَيْكَ
عَظِيمًا
صدق الله العظيم
سورة النساء آية
١١٣

# LIST OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# LIST OF ABBREVIATIONS

| Abbrev. | Meaning |
|---|---|
| **ACOG** | American Committee of obstetric and Gynecology |
| **AFP** | Alpha fetoprotein |
| **ALP** | Alkaline phosphatase |
| **ALT** | Alanine transaminase |
| **ARDS** | Adult respiratory distress syndrome |
| **AST** | Aspartate transaminase |
| **B-HCG** | Human chorionic gonadotropin |
| **CPB** | Cardiopulmonary bypass |
| **CCAM** | Congenital cystic adenomatoid malformation |
| **CHAOS** | Congenital high airway obstruction syndrome |
| **Co2** | Carbon dioxide |
| **CSF** | Cerebrospinal fluid |
| **CVS** | Chroinic villus sampling |
| **EEG** | Electroencephalography |
| **FCMB** | Fetal cell in maternal blood |
| **FIO2** | Fractional inspired oxygen |
| **GABA** | Gamma aminobutyric acid |
| **GFR** | Glomerular filtration rate |
| **GGT** | Gamma glutamate transferase |
| **ICU** | Intensive care unit |
| **IUGR** | Intra uterine growth retardation |
| IV | Intravenous |

# LIST OF ABBREVIATIONS

| Abbrev. | Meaning |
|---|---|
| **IVF** | Invitro Fertilization |
| **LDH** | Lactate dehydrogenase |
| **MAC** | Minimal alveolar concentration |
| **MGSO4** | Magnesium sulphate |
| **NMDA** | N-methyl D-aspartate |
| **NO2** | Nitric oxide |
| **NPO** | Nothing per os |
| **NT** | Nuchal translucency |
| **Paco2** | Arterial carbon dioxide tension |
| **Pao2** | Arterial oxygen tension |
| **PAPP-A** | Pregnancy-associated plasma protein A. |
| **PGD** | Preimplantation genetic diagnosis |
| **Ph** | Phosphate |
| **PIH** | Pregnancy-induced hypertension |
| **SLOS** | Smith-Lemli-Opitz SYNDROME |
| **TBG** | Thyroxin binding globulin |
| **TRAP** | Twin reversed arterial perfusion |
| **TSH** | Thyroid stimulating hormone |
| **TTTS** | Twin to twin transfusion syndrome |
| **UK** | United Kingdom |
| **USA** | United States of America |

# INTRODUCTION

Surgical intervention is considered when a fetus presents with a congenital lesion that can compromise or disturb vital function or cause severe postnatal morbidity. Hydronephrosis, sacrococcygeal teratoma, hydrocephalus, meningomyelocele and diaphragmatic hernia are some of the defects that can be diagnosed by imaging and are amenable to intervention. The combination of underdeveloped organ function and usually life-threatening congenital malformation places the fetus at a considerable risk. Fetal surgery also leads to enhanced surgical and anesthetic risk to the mother including hemorrhage, infection, airway difficulties and amniotic fluid embolism ***(Liley, 2004).***

Anesthetic considerations are identical to those for non-obstetric surgery during pregnancy although the fetus is the primary patient in these circumstances ***(Littleford, 2004).***

There are three basic types of surgical interventions: Ex-utero intrapartum treatment (EXIT), Midgestation open procedures. Minimally invasive midgestation procedures. These procedures require many manipulations and monitoring in both the mother and the unborn fetus ***(Liley, 2004).***

Fetal sedation by placental transfer of maternally administered medication is not reliable and does not ensure an anesthetized or immobile fetus ***(Cauldwell, 2002).***

According to their individual solubilities, the inhalational anesthetic agents used for maternal general anesthesia and uterine relaxation should be given enough time to equilibrate in fetal tissues ***(Cauldwell, 2002).***

Whether the fetus feels pain or not and when, it's still the subject of vigorous debate ***(Van Lingen et al., 2002).***

Additional fetal anesthesia can be provided by direct intramuscular or intravascular (via the umbilical vein) administration of opioids and neuromuscular blocking agents. Pancuronium is often chosen for fetal paralysis because of its long duration and vagolytic properties, helping the elevation of fetal heart rate and maintain cardiac output ***(Rosen, 2001).***

# AIM OF THE WORK

The aim of this essay is to spot light on the importance of surgical intervention when a fetus presents with a congenital lesion that can compromise or disturb vital function or cause postnatal morbidity.

# PHYSIOLOGICAL CONSIDERATIONS

Maternal changes in pregnancy occur as a result of hormonal alterations, mechanical effects of the gravid uterus, increased metabolic and oxygen requirements, metabolic demands of the fetoplacental unit, and hemodynamic alterations associated with the placental circulation. Such changes become more significant as pregnancy progresses, and they have major implications for anesthetic management, especially in high-risk parturients ***(Palmer & Craig, 2002)***.

## Respiratory System:

Changes in the respiratory system are of great significance to the anesthetist and may be categorized as anatomical and physiological ***(Palmer & Craig, 2002).***

## Anatomical changes:

Hormonal changes to the mucosal vasculature of the respiratory tract lead to capillary engorgement and edema of the upper airway down to the pharynx, false cords, glottis and arytenoids. This can be exacerbated by fluid overload or edema associated with pregnancy-induced hypertension (PIH) or pre-eclampsia ***(Elkus & Popovich, 1992).***