MALAYSIAN SOCIETY OF ANAESTHESIOLOGISTS

Year Book 2016/2017

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Bukit Jalil, 57000 Kuala Lumpur, Wilayah Persekutuan
Tel: (603) 8996 0700, 8996 1700, 8996 2700
Fax: (603) 8996 4700
Email: secretariat@msa.net.my

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Preface

Greetings from the Editors.

Once again, we proudly present to you the 2016/2017 edition of the Malaysian Society of Anaesthesiologists (MSA) Year Book.

As the chosen editors, we have decided to include articles from an all rounded list of subspecialties to highlight the accomplishments of everyone following our theme:

"Our Achievements, Our Vision"

The topics range from research articles relevant to our daily practice such as neuromuscular blockade and acute pain management with opioids to an informative review on something we should not take for granted - informed consent. Anaesthesia for new procedures such as EXIT will raise our awareness to emphasise on multidisciplinary teamwork in increasingly complex surgical techniques. And, of course, we take a look at the accomplishments of setting up a one-of-its kind anaesthetic allergy clinic to serve the whole country and also put our years of work in labour pain into perspective.

Next, readers should not miss a well-written review backed by results from an author’s own studies demonstrating how outcomes in intensive care units are affected by our own hospital organizations in early warning systems and the number of after-hour discharges. On a lighter note, our charitable side is portrayed as the saying goes “Pictures are worth a thousand words” in a collaborative work with Mercy Malaysia. And, finally, for most of us who may not have worked or even stepped foot in the far east of Borneo, a glimpse of a rewarding career of a dedicated young specialist posted to the region ends our list.

We would like to extend our sincere gratitude to all the authors and reviewers who had spent a considerable amount of their precious time to make this book happen. We hope you will enjoy this book and be encouraged to soar to greater heights in the future.

Dr Loh Pui San
Dr Chaw Sook Hui
Editors
MSA Year Book 2016/2017
Foreword

It gives me great pleasure to pen this foreword for the Malaysian Society of Anaesthesiologists Year Book 2016/2017, our ninth edition. This year’s theme on “Our Achievements, Our Vision” is aptly chosen as we put our hearts and mind into greater accomplishments and performances for the betterment of the fraternity and the community.

The chapters in the book are well written, researched and peer-reviewed. Many articles are based on results from authors’ own studies and I am proud to see this development as we start to build a strong research culture, move forward and practice evidence-based medicine without relying only on data from other regions. It is also heartening to read regarding our accomplishments in other aspects such as the anaesthetic allergy clinic and professional growth of our colleagues even in challenging environments.

On behalf of the MSA, I would like to express our grateful thanks to all the authors and peer reviewers for their contribution and commitment to this Year Book. Our thanks also go to the Editors, Dr Loh Pui San and Dr Chaw Sook Hui, for their dedicated efforts and resources in bringing out this book.

Dato’ Dr Jahizah Hassan
President
Malaysian Society of Anaesthesiologists 2017/2018
The Ex-utero Intrapartum Treatment (EXIT) Procedure: Anaesthetic Concerns And Our Experience

Carolyn Chue-Wai Yim, Li Lian Foo
Department of Anaesthesia and Critical Care, University of Malaya, Kuala Lumpur, Malaysia

INTRODUCTION

The Ex-utero Intrapartum Treatment (EXIT) procedure allows for foetal airway management and resuscitation. It was initially performed in the 1990s as ex-utero intrapartum tracheoplasty procedure. This procedure involved the removal of tracheal clips, which had been placed at an earlier setting for occlusion of the trachea to ensure foetal lung growth in the treatment of severe congenital diaphragmatic hernia. As the technique was adapted to secure the airway for cases in the presence of life-threatening airway obstruction, the pseudonym was changed to ex-utero intrapartum treatment. Operation on placental support (OOPS), on the other hand, was an initial method without trying to prevent uterine contraction that eventually developed into EXIT characterized by controlled uterine hypotonia to preserve uteroplacental circulation. These life threats can be as a result of cystic hygromas, haemangiomas, to difficult airways such as in arthrogryposis multiplex congenita.

Currently, the procedure is performed in conjunction with an elective cesarean section. The maintenance of utero-placental circulation allows for both diagnostic and therapeutic procedures to be performed on the foetus. The anaesthetic concerns are broadly divided to maternal factors and foetal factors. The paramount aim is to ensure profound uterine relaxation, foetal anesthesia and maintenance of the maternal foetal circulation. A multidisciplinary team approach is the key to provide optimal care for both mother and foetus.

MATERNAL CONCERNS

A complete medical history and physical examination of the mother should be performed before EXIT procedure. Patients with significant cardiac or pulmonary disease may not be ideal candidates for the EXIT procedure. The presence of polyhydramnios is a common finding as a result of compression of both the trachea and esophagus by neck masses in the foetus. Patients may have had a history of amnioreductions or premature contractions. The risk of aspiration and difficult intubation should also be addressed.

The stark differences between the EXIT procedures versus standard Cesarean section are listed below:

1. Usage of deep volatile anaesthesia (e.g., above 2 MAC)
2. Longer gap between induction time till delivery time
3. The need for vaspressors/monotropes (commonly dopamine) infusion to sustain appropriate maternal hemodynamics
4. The use of nitroglycerine infusion for optimum uterine relaxation
5. Partial delivery of foetus to ensure maintenance of placental support
6. Providing foetal anaesthesia for airway management

Timing of Delivery

This decision should be made after a team discussion. The goal is to extend the pregnancy close to term to decrease the complications of pre-maturity. However, the risk of pre-term labor and development of both maternal and foetal compromise must also be taken into consideration. Hence there is no definite ideal time of delivery.

Incision

In most instances, a transverse uterine incision at the lower segment is sufficient. However, in cases such as pre-term gestation, large masses or difficult foetal access, a vertical uterine incision may be required. This potentiates the risk of hemorrhage and also has implications on future pregnancies.
Malaysia
finding as a result of scar tissue and esophagus... patients may have
ons or premature contraction and difficulty.

The EXIT procedures are listed below:7

- Anaesthesia (e.g., above the
  production time till... fusion to sustain... fusion for optimum
  maintenance

- Anaesthesia for airway

- Team discussion.

- Close to term to premature parity. However, the development of both
  must also be taken... is no definite ideal
to preserve uterine volume and prevent placental separation.

**Iontropes**

Achieving profound uterine relaxation can result in a decrease in maternal blood pressure that leads to a reduced uteroplacental perfusion. Thus, maternal arterial blood pressure monitoring is recommended to ensure beat to beat monitoring. Treatment of maternal hypotension includes fluid resuscitation with ringsers lactate or albumin 5% and intermittent boluses of ephedrine or phenylephrine.

Dopamine infusion can also be considered as it is easily titratable and improves blood flow to the kidneys and presumably also increases uterine blood flow.5,6

**Bleeding**

Significant bleeding should be anticipated with the use of tocolytic agents to facilitate uterine relaxation and possible prolonged operation time due to the complexity of the procedure. Two large bore branulas and the vigilance of the attending anaesthesiologists are of paramount importance. Local Massive Blood Transfusion Protocol (MTP) should be instituted early if bleeding occurs.

**Uterine Contraction**

Post delivery, deep uterine relaxation is usually reversed by reducing the MAC of the inhalational agents. The use of oxytocin after delivery of foetus is usually employed with predictably favorable results. Most anaesthesiologists will continue with IV oxytocin infusion postoperatively. Other uterotonic agents mentioned are carboprost, methylergonovine, and misoprostol. Uterine massage can also facilitate uterine contraction.

The anaesthetic principles are summarized as below:7

1. Appreciation of anatomical and physiological changes in pregnancy
2. Addressing hypotension
3. Ensuring adequate uteroplacental blood flow
4. Prevention of aortocaval compression
5. Provide safe anaesthesia
6. Selecting anaesthetic drugs and agents with rapid titratability
7. Monitoring of foetus prior to delivery
8. Making appropriate perioperative adjustments as guided by the results such as hemoglobin level and blood pressure
9. Preventing placental separation following partial delivery of the foetus
10. Maintaining fetal-placental circulation
11. Provision of foetal anesthesia for foetal airway manipulations

Postoperatively, the mother is managed in a high dependency unit given the risk of post partum haemorrhage as a result of uterine atony is still possible. Pain management can be achieved with patient controlled analgesia.

**FOETAL CONCERNS**

Mortality in neonates with upper airway obstruction has been reported to be up to 20% following a normal delivery. The EXIT procedure allows for foetal airway management in a controlled situation while still on placental circulation, prolonging operative time. This avoids ‘crash’ intubations, hypoxia, ischaemic brain injury, and death.

Current indications for EXIT have expanded to include various lesions compromising the foetal airway or compromising foetal resuscitation, such as the following:

<table>
<thead>
<tr>
<th>INDICATIONS FOR EXIT</th>
<th>EXAMPLES</th>
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<tr>
<td>Reversal of tracheal occlusion</td>
<td>Following tracheal clip or balloon procedures for CDH</td>
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<td>Suspected airway compromise</td>
<td>Foetal Neck Masses</td>
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<td>Congenital High Airway Obstruction Syndrome (CHAOS)</td>
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<td>Suspected resuscitation compromise</td>
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<td>Teratoma, lymphangioma</td>
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<td>Large lung masses</td>
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<td>CCAM</td>
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<td>Bronchopulmonary sequestration</td>
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<td>HLHS with intact/restrictive atrial septum</td>
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<td>Severe aortic stenosis</td>
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<td>High risk CDH</td>
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<td>Lung/head ratio&lt;1 + liver herniation</td>
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*CDH - Congenital Diaphragmatic Hernia, CCAM - Congenital Cystic Adenomatoid Malformation, HLHS - Hypoplastic Left Heart Syndrome
achieved with
tine obstruction following a normal allows for foetal situation while
longing operative hypoxia,

have expanded to
promising the foetal resuscitation, such

Preoperative Concerns

Amniocentesis may be needed to rule out major chromosomal abnormalities. Maternal-foetal ultrasound can detect cardiac malformations or heart failure presenting as hydrops fetalis, which carries poor prognosis. Estimated foetal weight is used for drug dose calculation. Ultrafast foetal MRI is increasingly used to delineate relationship of neck masses to the airway.

Establishing the foetal airway may involve
1. Direct laryngoscopy and intubation,
2. Rigid bronchoscopy followed by intubation with armoured ETT,
3. Resection of neck mass followed by tracheostomy or retrograde intubation over ETT exchanger, or

All the above contingencies must be covered for when preparing airway equipment.

A second, adjacent operation theatre must be prepared in case the foetus needs immediate surgery after EXIT. Both theatres must be equipped with resuscitation equipment and warmed to 26°C. Suggested resuscitation drugs include adrenaline 1µg/kg, atropine 20µg/kg, calcium gluconate 30mg/kg and type O+ packed red cells. 2.5 and 3.0 Fr feeding tubes may be needed for surfactant administration.

Monitoring and IV Access

Continuous foetal monitoring is needed to detect changes in foetal well-being. This includes pulse oximetry applied to the hand. Covering the oximeter with foil may reduce interference from ambient light. Initial readings usually range between 60-70% prior to intubation. Levels <40% represent inadequate foetal oxygenation. Vernix, tissue edema, low perfusion and high ambient light may cause difficulties in capturing pulse oximetry in the foetus. The use of foetal scalp electrode has been reported to help in continuous monitoring of heart rate.

Continuous intraoperative foetal echocardiography can detect heart rate, intraventricular volume, myocardial contractility and ductal constriction.

In the foetus, cardiac output is more dependent on heart rate than stroke volume. The foetus has high vagal tone and low baroreceptor sensitivity. During stress, this causes the foetus to respond with reduced heart rate. In addition, inhalational anaesthetics cause direct foetal myocardial depression, vasodilatation and changes in arteriovenous shunting. The above combination leads to foetal hemodynamic instability.

Other issues unique to the foetus include thin skin, resulting in increased heat loss, a low blood volume and poor coagulability.

Foetal Physiology

Support of the foetus during EXIT depends completely on the uteroplacental gas exchange. This is affected by uteroplacental blood flow from the uterine artery, and fetoplacental blood flow through the umbilical arteries. Uterine artery flow is affected by maternal systolic blood pressure and myometrial tone, both of which are reduced by volatile anaesthetics. Umbilical artery flow is affected by foetal cardiac output and placental vascular resistance.

Infant Physiology

In the newborn, cardiac output is determined by stroke volume, which is dependent on preload, afterload and contractility. The foetus has high vagal tone and low baroreceptor sensitivity. During stress, this causes the foetus to respond with increased heart rate. In addition, inhalational anaesthetics cause direct foetal myocardial depression, vasodilatation and changes in arteriovenous shunting. The above combination leads to foetal hemodynamic instability.
detected in the foetus as early as 20 weeks gestation. Foetal anaesthesia is primarily from transplacental transport of volatile anaesthetics. This takes about an hour to reach 70% of maternal levels. Intramuscular foetal injection of fentanyl 10-20μg/kg, atropine 20μg/kg and muscle relaxant has been used to supplement anaesthesia before foetal incision. The high concentration of volatile anaesthetics used during EXIT (up to 2-3 MAC) has raised concerns of foetal hypoxia, acidosis and anaesthetic overdose. Alternatives to high dose inhalational anaesthesia include TIVA with propofol and remifentanil. Remifentanil crosses the placenta and is rapidly metabolised. Clearance is independent of body weight or age and comparable in preterm and term infants. Maternal remifentanil infusion provides foetal immobilisation and analgesia during foetal surgery.

**Foetal Outcomes with EXIT**

Long term effects of EXIT, including the effect of high concentration inhalational agents on the developing brain, are still being studied.

**OUR EXPERIENCE**

To date, we had performed two EXIT procedures at our centre. Both cases were indicated because of a significant large neck mass of the foetuses which would lead to airway compromise after delivery. The anaesthetic of choice was general anaesthesia with keeping a slightly higher than normal MAC (around 1 - 1.2 MAC). This provided adequate uterine relaxation without the need for commencement of a nitroglycerine infusion. The airway of the first foetus was secured easily by the neonatologist upon delivery of the head. However, the neck mass for the second foetus was significantly larger and multiple intubation attempts by the neonatologist and ENT (approximately 25 minutes after hysterotomy) failed to secure the airway. In view of easy mask ventilation for the foetus, we decided to deliver the foetus to allow further intubation attempts with a better positioning. We succeeded in securing the airway, and this was followed by decompression of the cystic hygroma and tracheostomy.

**SUMMARY**

The core principles of EXIT are the preservation of uteroplacental circulation through controlled uterine hypotonia, preservation of uterine volume to prevent placental abruption, maintaining maternal normotension despite anaesthesia, and achieving foetal anaesthesia without cardiac depression. Indications for EXIT have evolved from the reversal of tracheal occlusion to various lesions causing foetal airway or cardiovascular compromise. It is now an established method of securing the complex foetal airway with minimal maternal morbidity and with good short term outcomes. A multidisciplinary approach and meticulous planning are essential to its success.

**References**


MAC (around the 35-50% functional residual capacity, based upon the first description of the first introduction of a simple method of easy mask technique for the easy delivery of the first case). Of note, securing the mask to the patient in an airtight manner is essential to the prevention of hypoxia and achieving maternal-fetal arterial blood gas monitoring and ensuring maternal-fetal oxygenation and achieving maternal-fetal arterial blood gas monitoring and ensuring maternal-fetal oxygenation.


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