Techniques of Fetal Reduction and Feticide

Logie Govender
Introduction

• Clinical practice – 2 decades
• Various **indications** for feticide
  – Multifetal pregnancy reduction (MFPR)
  – Severe fetal anomaly
• Different **methods** described
  – Transabdominal and transvaginal
  – Ultrasound guided or Endoscopic
• **SA CTOPA** – any gestation for anomaly
• **Moral /Social / Psychological / Ethical issues**
# Overview

## Indications

<table>
<thead>
<tr>
<th>Multifetal Pregnancy Reduction (MFPR) ≥ Triplets</th>
<th>Techniques</th>
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<tr>
<td>- Ideally 11 - 12 weeks</td>
<td>- DC - intracardiac KCl</td>
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<td>- High order gestation</td>
<td>- Intracranial KCl</td>
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<tr>
<td>- Reduction of normal fetuses</td>
<td>- MC - cord occlusion</td>
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<td>- Intrathoracic Amniotic Fluid</td>
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<tr>
<th>Selective TOP (&gt;12 weeks)</th>
<th>Twins &amp; Higher Order gestation</th>
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<td>- Abnormal fetuses</td>
<td>- MC - Cord occlusion</td>
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<td>- R or D twin in TTTS / TRAPS</td>
<td>- DC - lethal drug injection</td>
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<th>Late TOP (&gt;20 weeks)</th>
<th>Singleton pregnancies</th>
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<td>- Severe fetal anomaly</td>
<td>- Intracardiac injection</td>
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<td>- Maternal interest</td>
<td>- Umbilical vein injection</td>
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Multifetal Pregnancy Reduction

- General comments -

• Outpatient procedure / Sedation / Local A

• Extensive counselling (difficult decision / traumatic)
  – Risks & complications
    • Miscarriage (5%) / PROM / PTD
  – Informed consent / Check Rh type

• Experienced operator

• Trained staff – respect views & attitudes

• Appropriate equipment

• Good resolution ultrasound machine
MFPR

- **Main goal** ↓ complications with high order gestations
  - Reduce *perinatal* morbidity and mortality
    - severe prematurity and its consequences
    - prevent neurodevelopmental handicaps
  - Reduce the risk of *maternal* complications
    - Preclampsia
    - Abruptio placentae
- **Essential**
  - Confirm chorionicity / aneuploidy screen(NT) / anomaly scan
  - Determine number of fetuses to be reduced
- **There is generally no medical indication for MFPR in twins**
MFPR - Techniques

- **Transabdominal** USG-guided procedure (11-12 wks)
  - Establish chorionicity / number of fetuses
  - All normal - reduce fetuses close to uterine fundus
  - DC Pregnancy
    - 2-4 mls *intracardiac KCl* - harmless dose to mum
    - most common technique
    - *intracranial KCl* *(Lembet et al, 2009)*
  - MC pair – ?TOP both fetuses in DCTA triplets!
    - *intrathoracic Amniotic Fluid* *(Shang-Gwo Horng, et al, 2004)*

- **Transvaginal** needle aspiration <10 weeks – Embryo reduction
  - General Anaesthetic
  - Too early for aneuploidy screen
  - ↑ risk of infection
  - Spontaneous fetal reduction

- **Transcervical** aspiration is no longer used

Intracranial KCl injection
-MFPR in DC pregnancy-

• New technique - First reported case series (2009) Turkey
• Difficulty in reaching the thorax due to fetal position
• Fetal intracranial injection of KCl (2-3mls)
• **Comment**: Technically easier procedure than the intrathoracic approach
• NB: technique should be reserved for selected cases of MFPR by experienced operators

Intrathoracic Amniotic Fluid

-MFPR in MC pair-

- 2 case reports – DCTA triplets (MC pair) - 10 weeks [Taiwan]
- Outpatient procedure
- 18G needle inserted into amniotic sac under TVS guidance
- 0.5 ml amniotic fluid (AF) aspirated from sac of 1 MC twin
- Needle then advanced into thoracic cavity
- Injected 0.2ml AF - fetal heartbeat ceased immediately
- Outcome: 1 - PROM at 25 weeks
  2 - uneventful delivery at 36 weeks (>2 kg each)
- Conclusion: Intrathoracic injection of AF to create a tamponade is an alternative management for fetal reduction of a MC pair

## MFPR – Outcome

### Retrospective study of fetal reduction n=334

<table>
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<tr>
<th>MFPR &lt;15 weeks</th>
<th>n = 313</th>
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<tr>
<td>• Miscarriage rate</td>
<td>- 9.12%</td>
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<tr>
<td>• PTD &lt;33 weeks</td>
<td>- 13.33%</td>
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<tr>
<td>• PTD &lt;36 weeks</td>
<td>- 38.60%</td>
</tr>
<tr>
<td>• Total fetal loss</td>
<td>-16.25%</td>
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<tr>
<td>• Median GA at delivery</td>
<td>- 35 weeks</td>
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<th>MFPR &gt; 15 weeks</th>
<th>n= 21</th>
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<tr>
<td>• PTD &lt;33 weeks</td>
<td>= 3x ↑</td>
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<tr>
<td>• At least one live neonate</td>
<td>- 83.75%</td>
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<th>Triplets to twins</th>
<th>n=185</th>
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<tr>
<td>• Miscarriage rate</td>
<td>- 8.25%</td>
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<tr>
<td>• PTD &lt;33 weeks</td>
<td>- 11.18%</td>
</tr>
<tr>
<td>• PTD &lt;36 weeks</td>
<td>- 40.59%</td>
</tr>
<tr>
<td>• Total fetal loss</td>
<td>-15.41%</td>
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<tr>
<td>• Median GA at delivery</td>
<td>- 36 weeks</td>
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### Conclusion on MFPR
- MFPR <15 wks - ↓ severe PTD
- Establish correct chorionicty
- Need for 1st T diagnosis

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Selective Feticide (SF)

• Indications (Twins or Higher order gestation)
  • usually >12 weeks
  • ↑NT in high order gestation for MFPR
  • Acardiac twin, anomalous fetus
  • D or R twin in TTTS

• DC pregnancy
  • Intracardiac KCl - common method

• MC pregnancy
  • Cord occlusion - different techniques
Cord Occlusion techniques

-Review of Literature-

**Main Goal**: Interrupt blood flow to candidate fetus while avoiding exsanguination of the co-twin

- Bipolar cord coagulation
- Cord ligation / compression
- Radiofrequency ablation
- Laser photocoagulation (Nd:YAG)
  - high failure >20wks
- **Cord embolisation** (Thrombogenic coils/ sclerosants)
  - high failure rate
  - occluding only one vessel
1. Bipolar cord coagulation

-Gold standard-

• Outpatient procedure/ Ultrasound guidance

• Advantages
  – Short duration of surgery
  – Single port entry
  – Simple and effective
  – Successfully performed as late as 26 weeks

• Avoid septum disruption → reduce risk
  – Cord entanglement
  – Amniotic band syndrome

• Complications: Cord haemorrhage/PROM/PTD
1. Bipolar cord coagulation

-Technique-

- Ultrasound guidance / cannula inserted
- 3mm endoscopic bipolar coagulation forceps
- Cord loop grasped and coagulation initiated at 20 W power -30s
- Effect judged by appearance of turbulence / steam bubbles
- Power slowly increased to achieve complete occlusion
- Evaluated by color Doppler
- Forceps subsequently freed from cord by gentle manipulation
- Two additional cord segments coagulated in a similar fashion

2. Fetal cord ligation

-Suture Technique-

- Case Report of TTTS: USG guided cord ligation  [France]
- One end of a monofilament suture is held by 2 mm biopsy forceps and passed through a 2.1-mm cannula
- Suture hooked over the cord
- The biopsy forceps is then directed under the cord to catch end of suture and pull it out of cannula
- Autostatic Roeder's knot tied extra-abdominally and pushed using an Endoloop pushing device

3. Fetal cord compression

-Technique-

- Retrospective observational study - 2 cases – USG guided
- 2.1mm cannula and an 18G needle [France]
- Needle inserted near loop on opposite side to cannula
- Monofilament suture passed down needle and caught under cord by biopsy forceps inserted through the cannula
- Cord compression against uterine wall
  - Achieved by pulling on suture ends and knot above maternal abdominal wall
- Suture untied 24 h later
- If no persistent blood flow on color Doppler- removed

4. Radiofrequency ablation

- **New technique** [Thermocoagulation] < 16 wks [USA]
  - Cord coagulation by inducing temperature changes using high-frequency alternating current
  - Efficacious technique for selective feticide in fetuses with TRAP sequence

- **Adverse effects**
  - Extent of the thermal damage is not entirely controlled by the operator
  - Intrafetal haemorrhage
  - Amniotic band formation
  - Maternal thermal injuries

Radiofrequency needle

Position of needle in fetal abdomen with prongs deployed (arrow).

Umbilical cord occlusion

Outcomes

• **Systematic Review**  n=345  [Italy]
• **Indications**
  • TTTS
  • TRAPS
  • Severe malformation
  • Discordant growth
• **PROM**- complicated all the procedures
  • 59% - within 4 postoperative weeks
• **Demise of surviving fetus** -15%
  • 79% - within first 2 postoperative weeks

Umbilical cord occlusion

Outcomes

• **Survivors per cord occlusion technique:**
  - Radiofrequency ablation - 86%
  - Bipolar diathermy cord coagulation - 82%
  - Laser cord coagulation - 72%
  - Cord ligation - 70%

• **Conclusion: Systematic Review**
  - In spite of favorable outcomes, the optimal surgical approach remains undetermined

Feticide in Late TOP  
-Beyond clinical viability-

Contentious issue/ethical implications/ counselling

**Indications**
- Severe fetal abnormality
- Maternal interest  

**Methods** Transabdominal USG guided procedure
- Intracardiac / intrapericardial
- Umbilical vein puncture
- Heart aspiration till asystole

**Drugs**
- Lethal: KCl / lignocaine / digoxin / hyperosmolar urea
- Non-drugs: normal saline → cardiac tamponade
- Fetal pain and analgesia [5µg sufentanil injection]
Feticide
-preparation-

• **Experienced operator / Fetal Medicine specialist**
• **Assistant** (doctor)
  • to aspirate heart blood and administer the KCl
  • assist with concomitant procedures if indicated
  eg: amniodrainage, cephalocentesis, paracentesis
• **Nurse midwife** - attend to patient
  • keep patient comfortable during procedure
• **Scrub sister** – set up / assist with procedure
  • collecting and labelling blood specimens
• **Sonographer / assistant** to ‘drive’ the ultrasound machine as required during the procedure
Feticide – Intracardiac KCl
- local experience technique-

- **Outpatient procedure** / USG guidance ≥ 24 weeks
- **Premedication** - Pethidine 50mg IVI ± antiemetic & Mefoxin 2g IVI [30 mins before procedure]
- Cleanse maternal abdomen / ultrasound probe and cord
- Obtain a 4 chamber view - record FHR
- **Free-hand technique** / continuous ultrasound guidance
- **Local anaesthetic** 5mls of 2% lignocaine at entry site
- 20 G 15cm spinal needle - targeting LV or most accessible chamber of fetal heart – initial aspirate blood
- 15% KCl administered under direct vision - until asystole
- Rescan 30 mins later – confirm asystole
Results - 5 year Audit

- Gestation: 24-41 weeks [n=2209]
- Prevalence severe fetal abnormality – 11.5%
- Acceptance rate LTOP – 75%
- Brain 38% and spine 20% – most common
- Diagnosis to performance of feticide 10 days (0-42 days)
- Mean duration of procedure – 12mins (6-25mins)
- Median volume KCl - 10mls (5-16mls) (⅔ cases > 30 wks)
- No maternal complications
- Stillbirths were confirmed in all cases
1. Aspiration of blood from fetal heart

- Case series (2009) - report on 9 cases [Turkey]
- Aspirated blood from FH until cardiac arrest
- Conclusion: Fetal heart blood aspiration
  - Safe non-drug method of feticide

2. Cardiac Tamponade to induce asystole

- **Case report** - Taiwan (2009)
- Induce a cardiac tamponade
  - Injecting 10 mls normal saline into pericardial space
  - Fetal demise with minimal maternal risk
- Procedure performed just prior to IOL
  - Following failed 3ml intracardiac KCl injection
- **Conclusion**: Cardiac tamponade (normal saline)
  - safe non-drug alternative of inducing fetal asystole

3. Funipuncture KCl for feticide in LTOP

- French study, (2002)  n=10 cases  22-38 weeks
- Umbilical vein puncture under USG guidance
- 5μg sufentanil followed by 2g KCl
- No ECG changes observed
- Maternal plasma KCl levels - no significant variations

**Conclusion:**
- Umbilical vein KCl safe procedure for the mother
- allows the fetus to die without pain

4. Use of Lidocaine for feticide in LTOP

- French study  n=50 cases  20-36 weeks
  - 7-30mls Lidocaine into umbilical vein (UV)
  - Preceded by 5µg sufentanil injection
- Success rate of 92%
  - one case - resort to intracardiac KCl
  - 3 cases - KCl via umbilical vein
- **Conclusion:** UV puncture for fetal analgesia ffd by feticide is a safe procedure for the mother
  - Fetus dies without pain when LTOP is indicated
  - 1% Lidocaine - effective drug for feticide with doses below the toxic dose for the mother

Senat, M.V. et al. (2003) *BJOG, 110*(3), *296-300*
5. Cordocentesis vs Cardiac puncture

- Retrospective study (2002) UK
- Findings:
  - GA no effect on dose of KCl administered
- Dosage of KCl
  - up to 20 ml for cardiocentesis
  - 8 ml for cordocentesis
- **Conclusion**: cardiac and umbilical routes are safe

-Summary-

• Fetal reduction / feticide – sensitive topic
• Psychological / Social / Moral and Ethical issues
• Decision for feticide - Multidisciplinary team
• Views/ objections of women/ family/ Healthcare Wkrs
• Respect women’s autonomy – decision making
• Genetic counselling / informed consent
  – Potential risks & complications of procedures
• Operator experience & expertise
• Choose appropriate technique (MC vs DC)
• Good resolution machine
• Delivery plan/ Postnatal follow up + ongoing counselling
Thank You