SFM Fetal Therapy Practice Guidelines: Bipolar Cord Coagulation

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Abstract

Bipolar cord coagulation is modality available for the treatment of monochorionic diamniotic twins with any one of the following indications: discordant anomalous fetus, severe selective Intrauterine growth restriction (IUGR) (type 2 and type 3) in very preterm and premature fetuses, and selected cases of twin-twin transfusion syndrome when LASER photocoagulation is not feasible. Twin reversed arterial perfusion sequence with polyhydramnios and cardiac overload in pump twin, Multifetal reduction involving MCDA pair.

Keywords

- discordant anomalous fetus
- bipolar cord coagulation
- selective FGR
- TRAP sequence
- TTTS

Indications of Bipolar Cord Coagulation

1. Discordant anomalous fetus
2. Severe selective fetal growth restriction (FGR) (type 2 and type 3) in very preterm and premature fetuses
3. Selected cases of twin-twin transfusion syndrome (TTTS) when Light Amplification by Stimulated Emission of Radiation (LASER) photocoagulation is not feasible
4. Twin reversed arterial perfusion (TRAP) sequence with polyhydramnios and cardiac overload in pump twin
5. Multifetal reduction involving monochorionic diamniotic (MCDA) pair

Indications Explained

1. Discordant anomalous fetus:
   - The risk of discordant congenital anomalies is higher in MCDA pairs of twins. Few are lethal; others maybe nonlethal. Some abnormal fetuses may demise in utero, while others may survive till and beyond delivery. In case of one fetal demise; co-twin mortality (10%) and morbidity (hypovolemic hypoxic injury: 20–30%) may occur and hence selective feticide would be a viable option.
   - For the couple who choose to selectively terminate the nonlethal anomalous fetus, cord occlusion by cord coagulation is an option.
2. Severe selective intrauterine growth restrictions (IUGR) (type 2 and type 3) in very preterm and preterm fetuses:
   - In these fetuses where gestation is too early to deliver the babies, expectant management may lead to the death of the affected fetus in utero leading to complications like neurologic damage or demise in the surviving twin.
   - Cord occlusion prevents these complications for the surviving twin and helps in prolonging the pregnancy thereby reducing the morbidity of preterm birth to the normal/surviving twin.

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3. Selected cases of TTTS when LASER photocoagulation is not feasible:
   - Although evidence suggests the use of LASER photocoagulation is the method of choice for the management of stage 3 and stage 4 TTTS, this may not be feasible in all cases as LASER photocoagulation is costlier and technically challenging especially when the placenta is anterior. In such cases, cord coagulation may be used where the couple is not keen on salvaging both fetuses.
4. TRAP sequence with polyhydramnios and cardiac overload in pump twin.

In the TRAP sequence, the normal twin may have cardiac overload and cardiac failure. In the event of the demise of the acardiac twin, the surviving twin may have permanent neurological abnormalities or even demise. Cord occlusion by cord coagulation may prevent morbidity for the surviving twin.

Other techniques such as interstitial LASER or radiofrequency ablation are options and the technique of choice depends on the individual case and available expertise and equipment

5. Multifetal reduction in MCDA pregnancy:
   - This indication raises several ethical dilemmas and should only be considered on an individual case basis
   - If indicated and agreed, cord occlusion by cord coagulation is the method of choice.
   - With the use of KCL for fetal reduction, after the demise of the reduced twin, there may be sudden exsanguination and hypoperfusion of the surviving twin leading to permanent neurological damage or death.

Maternal Risks

Maternal Risks Are Extremely Rare

1. Injury to bowel and bladder
2. Injury to inferior epigastric artery leading to rectus sheath hematoma
3. Thermal injury to the mother

Fetal Risks

1. Thermal injury to the fetus.
2. Puncture of intertwin membrane and its complication including cord entanglement.

Other Risks

1. Preterm premature rupture of membranes
2. Procedure-related pregnancy loss: 10–15%
3. Chorionic villous vessel rupture (transplacental entry)
4. Rh isoimmunization (Rh-negative mothers)

Counseling statement for medical records:
Multifetal reduction in MCDA pregnancy:

Higher-order multiple pregnancy involving a monochorionic twin pair is associated with increased maternal and fetal risks. Maternal risks include anemia, preeclampsia, and gestational hypertension. Fetal risks include the risk of TTTS, s-IUGR, single fetal demise, and premature birth. If fetal reduction of one of the twins of the monochorionic pair is opted for, cord occlusion is the method of choice.

With the use of KCL for fetal reduction, after the demise of the reduced twin, there may be sudden exsanguination and hypoperfusion of the surviving twin leading to permanent brain damage or death and hence cannot be used in monochorionic gestation.

Cord coagulation is one of the techniques of cord occlusion.

Discordant Anomalous Fetus

The risk of congenital anomalies is higher in MCDA pairs of twins. Few anomalies in the fetus may be compatible with life and few are not compatible with life. There is a risk of sudden demise of the anomalous fetus inside the womb putting the normal fetus at a risk of permanent brain damage or death. Selective reduction of the anomalous fetus is an option to prevent such damage to the normal twin that can be achieved by cord coagulation. Karyotyping from amniotic fluid is a prudent step.

Severe selective IUGR (type 2 and type 3) in very preterm and preterm fetuses:

In some pregnancies with monochorionic twins, one of the twins may not grow up to its potential and in some instances, the blood supply to the fetus is severely hampered. In very premature and premature fetuses, delivery is not an option as this will put the normal fetus at risk of prematurity. But when pregnancy is continued, there is a risk of sudden demise of the growth-restricted fetus putting the normal fetus at a risk of permanent brain damage or death. Selective reduction in the severe growth-restricted fetus is an option to prevent such damage to the normal twin that can be achieved by cord coagulation.

Cord occlusion prevents these complications to the surviving twin and helps in prolonging the pregnancy thereby reducing the morbidity of preterm birth to the normal and surviving twin.

Selected cases of TTTS when LASER photocoagulation is not feasible:

Twin–twin transfusion is a unique complication of monochorionic twin pregnancy where blood from one twin called the donor twin is transfused to the other twin (called the recipient twin) through anastomotic channels called arteriovenous connections.

This may lead to decreased blood volume in the donor twin leading to decreased urine production, decreased water around the baby, abnormal blood supply to the baby, hydropic changes, or even death. In the recipient twin, there can be an overload of blood leading to increased urine production, increased water around the baby, heart failure and sometimes even death.

Although evidence suggests the use of LASER photocoagulation can salvage both the fetuses in 40 to 50% of cases and is the method of choice for the management of stage 3 and stage 4 TTTS, this may not be feasible in all cases as LASER photocoagulation is costlier and technical challenging especially when the placenta is anterior. In such cases, cord coagulation may be used to stop the sicker twin and the other twin can be salvaged.

TRAP sequence with polyhydramnios and cardiac overload in pump twin.

In the TRAP sequence, one of the twins of the monochorionic pair does not have a heart and the other normal twin pumps the blood through anastomotic channels into the umbilical artery of the acardiac twin. The normal twin may have an overload to the heart and heart failure. In the event of the demise of the acardiac twin, the surviving twin may have permanent neurological abnormalities or even demise. Cord occlusion by cord coagulation may prevent morbidity for the surviving twin.

Equipment and Devices and Vendors

Preoperative Checklist and Patient Preparation

1. Informed consent
2. Lignocaine test dose
3. Confirm Rh status
4. Intravenous access for the mother
5. Vaginal micronized progesterone 200 mg on the day and then for 2 days
6. Nitroglycerine patch 2 hours before the procedure
7. Indomethacin 50mg per oral stat followed by 25 mg Q6h (until 48-hour post-procedure)

Personnel required:

1. Experienced operator
2. Assistant trained in cord coagulation or handling the ultrasound probe
3. Circulating nurse to set tray and provide things
4. Sonographic assistant to handle ultrasound machine

Operating room requirements

1. Sterile Prep set (sterile drapes, probe cover, sterile gel, sponge forceps, gauzes)
2. Syringe: 10 cc for LA
3. 2% lignocaine
4. Blood pressure (BP) handle and sterile blade no.11
5. 3 mm trocar (**Fig. 1**)
6. Bipolar cord coagulator (**Fig. 2**)
7. Surgical diathermy machine (**Fig. 3**)
8. Suture material: Monocryl 0–3, needle holder.
9. Band-aid

Procedure steps:

1. Before prepping the maternal abdomen, cord accessibility is ascertained.

Fig. 1 3 mm Trocar.

Fig. 2 Bipolar cord coagulator.

Fig. 3 Surgical Diathermy machine.

2. The maternal abdomen is prepped and draped.
3. The ultrasound probe is sanitized with antiseptic and draped in a sterile manner.
4. Local anesthetic is injected into the skin at the site of insertion of the trocar.
5. A small skin incision (3–4 mm) is made at the site of insertion of trocar.

6. The forceps are inserted under ultrasound control, with the use of a purpose-made 3.3-mm cannula and trocar.
7. Care is taken with the insertion of the cannula to avoid the placenta, with the intention to approach the umbilical cord at a 45-degree angle as close to the placental cord insertion as possible.
8. This target is chosen because the cord is firm and, in cases of hydrops, the cord close to the placental insertion is usually thinner, which would allow a better grasp with the forceps. It is important to insert the cannula into a pocket of amniotic fluid that allows retraction of the forceps without re-entering the cannula.
9. The technique for insertion of the forceps involves lining up the echo from the opened forceps and the target area of the umbilical cord then rotating the forceps 90 degrees to grasp the cord.
10. The forceps are then retracted to pull the cord free of the uterine wall/placenta/fetus and to ensure that the forceps has grasped the whole of the cord.
11. Coagulation is done at power settings of 50 W applied for 10 to 30 seconds. This combination of power and time is adopted by trial and error, with shorter durations being applied in earlier gestations and smaller cords. Immediately after the power application, there is the appearance on ultrasound of echogenic "bubbles" rising from the cord. Coagulation is done at three different sites.
12. After successfully coagulating the cord, the absence of flow in the umbilical cord is recorded.
13. Fetal heart rate is checked. Sometimes the fetal heart rate is not completely stopped but is persistently bradycardic, less than 50 bpm.
14. The forceps are removed under ultrasound vision. The trocar is also removed under vision.
15. The skin incision is sutured with Monocryl 0–3, interrupted sutures.

Postoperative checklist:

1. Document no free fluid in maternal flanks by ultrasound immediately at the end of the procedure and after 3 hours post-procedure
2. Document the absence of fetal heart activity in the cord-coagulated fetus and the presence of fetal heart activity in the other fetus and show it to the mother at the end of the procedure and after 3 hours
3. Mother is given a couch for lying down for approximately 30 minutes after which she is allowed to ambulate and remain within the premises for the next 3 or 4 hours.
4. If no complaints, she could be allowed home, with the following advice:
   a. Avoid overstraining/lifting heavy weights for a week
   b. About 2 to 3% may experience light spotting of fluid or blood per vaginum—this is of no consequence
   c. Report to the hospital immediately if there is substantial leaking, bleeding, pain, generalized feeling of unwellness or fever
   d. To continue indomethacin 25 mg 6 hourly for a total of 48 hours
5. A detailed procedure report is generated, and one copy is handed over to the mother at the time of discharge.

Postoperative monitoring of mother and fetus:

1. Mother's pulse and BP recorded before the procedure, during the procedure, and immediately after the procedure
2. Pulse and BP recorded 30 minutes, 1 hour and 3 hours after the procedure. If no tachycardia, no further monitoring is required.
3. Fetal heart activity is documented during and end of the procedure. Document after 3 hours before sending mother home
4. Maternal flanks are to be imaged and looked for free fluid 3 hours after the procedure. Free fluid with normal vitals, usually is indicative of leaked amniotic fluid. This will usually get absorbed over 24 hours but may necessitate painkillers. If in doubt regarding the nature of the fluid, admission and close monitoring with or without a diagnostic tap will be required
5. Follow-up scans are scheduled after 2 weeks from the procedure and thereafter according to the clinical situation.

Report template: Cord Coagulation

Patient name	Mrs.	Visit date	/0 /17
Hospital ID		Visit No	
Referred by	Dr.	EDD	

Indication: MCDA twin gestation with
Gestational age: Weeks + days
Informed consent: Taken, Form G completed and signed
Maternal blood group and typing: Rh Anti D:
Procedure: Under continuous ultrasound guidance
Abdomen prep and draped.
2% Lignocaine for local anesthesia
3 mm incision for metal trocar and cannula
The umbilical cord of the fetus coagulated using bipolar diathermy; At three different sites.
The absence of flow in the umbilical cord was recorded at the end of the procedure.
Monocryl 3–0 for the skin.
Total duration of the procedure: min

At the end of the procedure

Fetal heartbeat	Fetus A	Fetus B
Before procedure	bpm	bpm
After procedure	bpm	bpm

Complications:

Conflict of Interest
None declared.

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Suggested reading

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