Original Article

Anaesthesia for foetoscopic Laser ablation- a retrospective study

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ABSTRACT

Background and Aims: Twin pregnancy with monochorionic placenta may be associated with arteriovenous vascular anastomosis of the placental vessels resulting in twin-to-twin transfusion syndrome (TTTS) and twin reversed arterial perfusion syndrome (TRAP). Foetoscopic LASER ablation (FLA) is the treatment of choice in reducing foetal mortality related to this. **Methods:** A retrospective review of medical records of 41 FLA procedures for TTTS and TRAP were analysed for anaesthetic management. Thirty-four patients received subarachnoid block, three combined spinal-epidural block, three general anaesthesia and one local anaesthesia with sedation. Nitroglycerine 5 mg patch was used for tocolysis 1 h before the procedure and continued for 24–48 h postoperatively. **Results:** Bupivacaine was used in 34 patients, and ropivacaine in three patients. Mean dose of bupivacaine 0.5% was 2.43 ± 0.32 ml and ropivacaine 0.75% was 2.85 ± 0.19 ml. The mean duration of surgery was 117.07 ± 28 min. Mild hypotension occurred in all patients under spinal anaesthesia and was treated with vasopressors. The foetal outcome among all 41 patients were 13 delivered live twins, 15 had a single live baby with intrauterine death of other twin baby. In 12 patients, both babies were intrauterine death. One patient was lost for follow-up. **Conclusion:** Foetoscopic procedures can be done under central neuraxial block, however occasionally general anaesthesia may be required.

Key words: Foetoscopic LASER ablation, twin reversed arterial perfusion syndrome, twin-to-twin transfusion syndrome

INTRODUCTION

With advances in high-resolution ultrasound and other diagnostic techniques, minimally invasive foetoscopic procedures, also called foetendo procedures,[1] are being carried out more frequently. Foetoscopic LASER ablation (FLA) involves minimal insult to uterus, while obtaining access to foetus through a single atraumatic trocar insertion.

Twin pregnancy with shared monochoronic placenta may be complicated with twin-to-twin transfusion syndrome (TTTS) and twin reversed arterial perfusion syndrome (TRAP). In TTTS, arteriovenous vascular communications occur in a shared monochorionic placenta of the twins. There is an imbalance in the blood flow between the developing foetuses. One of the twins receives excess blood flow called 'recipient twin' from the other twin called 'donor twin'.[2] In TRAP a twin with absent or non-functioning heart, called 'acardiac twin' gets its blood perfused from other twin called 'pump twin' through placental arterial anastomoses.[3] This results in overloading the heart in "pump" twin, resulting in polycythaemia, hydrops foetalis and congestive cardiac failure.[3] Interruption of abnormal vascular communications of placental vessel by LASER or radiofrequency coagulation,.[4,5] is the treatment of choice for TTTS and TRAP.[6]

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The anaesthetic concerns for foetoscopic procedures are those related to anaesthetising any pregnant patient for surgery such as preventing supine hypotension syndrome and maintaining uteroplacental blood flow, preventing unnecessary exposure of developing foetus to anaesthetic drugs . In addition, tocolytics are required to relax the uterus. They also decrease the possibility of causing premature labour, bleeding and premature rupture of membranes. Foetal anaesthesia is not required for TRAP and TTTS as there is no foetal surgery involved.[7] We present a retrospective analysis of anaesthetic management of 41 foetoscopic procedures, for TTTS and TRAP done in our institution.

METHODS

We carried out a retrospective analysis of patients who had undergone foetoscopic procedures in our hospital from 2010 to 2015. A total of 41 patients underwent foetoscopic procedures. Out of these 41 patients, 37 patients underwent FLA of placental vessels for severe TTTS and four patients for TRAP. All patients were evaluated preoperatively for any associated comorbidities such as pregnancy-induced hypertension, gestational diabetes, hypothyroidism, heart disease, bronchial asthma and anaemia. Pre-operative laboratory investigations included complete blood count, serum creatinine and blood glucose. All patients had received antacid prophylaxis with injection ranitidine 50 mg intravenously along with injection ondansetron 4 mg intravenously 1 h before surgery. All patients were explained about the surgical and anaesthetic procedure, and a written informed consent was obtained.

In all patients, 5 mg nitroglycerine patch was placed over the thigh, 1 h before surgery for uterine relaxation. Premedication consisted of injection glycopyrrolate 0.2 mg intramuscularly 30 min before surgery. Anaesthetic technique consisted of spinal anaesthesia in most patients with bupivacaine 0.5%, or ropivacaine 0.75%, 2 – 3 ml given intrathecally with 27-gauge Whitacre spinal needle, in the left lateral position. In some patients with expected prolonged procedure, combined spinal-epidural (CSE) procedure was performed. These patients received 0.5% bupivacaine (heavy) 2–3 ml intrathecally. An infusion of 0.5% bupivacaine was started epidurally, at the rate of 6-8 ml/h when patients started complaining of slight pain due to wearing off of spinal effect. Some patients under spinal or CSE analgesia requested for sedation and were sedated with midazolam 2 mg and fentanyl 25 μg. Patients who refused spinal anaesthesia, and patients whose spinal anaesthesia effect wore off due to prolongation of procedure, were given general anaesthesia with propofol 2 mg/kg, fentanyl 2 μg/kg and atracurium 0.5 mg/kg with endotracheal intubation. Anaesthesia was maintained with oxygen-air with sevoflurane 2% through a circle system at low flow rate of 1l/min. Patients were monitored with electrocardiogram, oxygen saturation and non-invasive blood pressure and end-tidal CO_2. At the end of the procedure, the effect of muscle relaxant was reversed with neostigmine 2.5 mg and glycopyrrolate 0.4 mg. Tracheal extubation was carried out with the patient fully conscious and with adequate breathing. Hypotension was treated with phenylephrine 100 μg or ephedrine 6 mg bolus doses; nitroglycerine patch was continued postoperatively and renewed every 24 h for tocolysis for next 24–48 h. No other tocolytic agent was used. All patients were hospitalised for 3 days and discharged on the 4th day.

RESULTS

A total of 41 American Society of Anesthesiologists Grade 1 and 2 patients underwent FLA procedures. Of these, thirty seven patients were for TTTS and four patients were for TRAP procedure [Table 1]. All patients were comfortable and tolerated the procedure well. Among 41 patients, 34 patients received spinal anaesthesia, three patients received CSE block; three patients received general anaesthesia and one patient received sedation with local anaesthetic infiltration of abdominal wall. Two patients with subarachnoid block required conversion to general anaesthesia because of prolongation of procedure [Table 2].

The level of block obtained with spinal and CSE block was T6–T8. The mean age of pregnant mothers was 28.95 ± 4.54 years (range 21–36 years). Out of 41 patients 13 patients (31.7%) had associated comorbidities. Of these, seven patients had gestational diabetes, three patients were hypothyroid, one patient had chronic hypertension, one patient was anaemic and one patient was known asthmatic.

Table 1: Foetoscopic procedures

Foetoscopic procedures	Number of patients	Mean gestation period (weeks)	Average duration of surgery (min)
TTTS	37	22.9	116.8
TRAP	4	19.6	120
All patients		22.70±3.1	117.07±28.1

TTTS – Twin-to-twin transfusion syndrome; TRAP – Twin reversed arterial perfusion syndrome

Mean gestational age at which patients underwent foetoscopic procedure was 22.70 ± 3.1 weeks (range 16–29 weeks of pregnancy). Thirty-four patients were given bupivacaine 0.5% and the mean volume used was 2.43 ± 0.32 ml (range 2–3 ml). Three patients received ropivacaine 0.75% and the mean volume given was 2.85 ± 0.19 ml (range 2.5–3 ml). Mean duration of surgery was 117.07 ± 28.1 min (range 60–180 min). Out of three patients who received CSE, two patients required activation of epidural with 6–8 ml of bupivacaine. Ten patients had nausea intraoperatively; however, none of them had vomiting. The outcome of the surgical procedure was that 13 patients delivered live twins, 15 patients delivered single live baby with other twin baby had intrauterine death (IUD). Twelve mothers had both the babies with IUD and preterm labour. One patient was lost for follow-up [Table 3].

DISCUSSION

TTTS and TRAP are complications of monochorionic placental twins due to sharing of the blood supply through common chorionic blood vessels, and selective LASER photocoagulation of abnormal vascular communications is the treatment of choice.

FLA procedures for TTTS and TRAP involve manipulation of placenta and umbilical cord vessels, and do not involve foetal surgery, and hence no foetal anaesthesia is required.[7] Nausea and vomiting can occur during the uterine manipulation of foetoscopic procedure. Ten of our patients had nausea intraoperatively; however, none of them had vomiting and all of them had received ondansetron intraoperatively.

Tocolysis is a very essential component of foetoscopy. Tocolysis helps in relaxation of uterus for amniocentesis and intra-amniotic procedures. Nitroglycerine, magnesium sulphate and nifedipine are commonly used as tocolytic agents. In this study, all patient received nitroglycerine 5 mg patch 1 h before FLA and was continued postoperatively for 24–48 h. Preterm labour, bleeding and premature rupture of membranes are the problems associated with FLA. Tocolytics helps to prevent these complications. Robinson *et al*.[8] have reported pulmonary oedema due to large amount of saline irrigation of amniotic cavity used during the foetoscopic procedure to facilitate surgical exposure. It was hypothesised that the pulmonary oedema resulted from irrigating fluid absorbed through myometrial venous channels accessed by the passage of the operating trocars. With relaxed uterus, tocolytics may further facilitate fluid absorption, especially when magnesium sulphate is used, which in addition can cause an increase in pulmonary capillary leak and may lead to pulmonary oedema.[9] None of our patients had pulmonary congestion or oedema.

Foetoscopy procedure may be done under local anaesthesia/monitored anaesthesia with sedation, central neuraxial block and/or general anaesthesia. Local anaesthesia involves infiltration of anterior abdominal wall and the peritoneum at the site of trocar insertion.[1,9] Bilateral transverse abdominis plane (TAP) block may also be administered. However, these patients require some degree of sedation. Fentanyl or morphine with or without midazolam may be used to induce acceptable maternal analgesia and sedation.[6,10] They produce stable haemodynamics. The combination, however, may cause respiratory depression of the mother. Midazolam crosses placenta and may cause reduction of foetal tone and help in stabilising the foetus for the procedure. Both fentanyl and morphine may cause negative foetal heart rate variability and bradycardia.[6,10] There has been one report of sedation with dexmedetomidine use in foetoscopic blood transfusion but requires further studies are required[11] as dexmedetomidine may cause maternal hypotension and bradycardia and reduction in placental blood flow.[11]

Regional anaesthesia for foetoscopy avoids need for rapid sequence induction and intubation and risk of

Table 2: Type of Anaesthesia

Technique	Number of patients	Drug and Dosage	Mean Dose (ml)
Subarachnoid Block	3	Ropivacaine 0.75%	2.85±0.19
Subarachnoid block	31	Bupivacaine 0.5% Heavy	2.43±0.32
Spinal for CSE	3		
Infusion for CSE patients*	2	Bupivacaine 0.5%	6-8ml/hour
Genera l Anaesthesia	3		
Local Infiltration with sedation	1		

*Two out of Three CSE Patients bupivacaine 0.5% infusion 6-8ml/h started

Table 3: Foetal outcome (all patients)

Outcome of foetuses	Number
Both babies live delivery	13
One baby live and other IUD	15
Both foetuses IUD with premature labour	12
Lost for follow up	1

IUD – Intra uterine death

difficult intubation of the mother. Regional anaesthesia has further advantage of avoiding sedative and other anaesthetic agents which may cause respiratory depression. Local anaesthetic dose requirement decreases during pregnancy.[3] The level of block should be at least till T8 level, preferably up to T6 level to avoid any pain or discomfort during foetal manipulation. In our patients, the level of T6–T8 was achieved. However, regional anaesthesia may cause maternal hypotension due to sympathetic paralysis. Severe hypotension may cause reduction of placental blood flow and foetal bradycardia. None of our patients had severe hypotension. Vasopressors like phenylephrine or ephedrine may be preferred over fluids to treat maternal hypotension, during foetoscopic procedures, as large volumes of fluid may precipitate pulmonary congestion or oedema, in the presence of tocolytics. In addition, correction of aortocaval compression by left lateral tilt helps in reducing the severity and incidence of maternal hypotension.[5] We found phenylephrine to be advantageous in our study as it reduced the heart rate, high probably due to nitroglycerine absorption. In this study, initial mild hypotension was observed following spinal anaesthesia. This was treated with phenylephrine or ephedrine to maintain normal blood pressure. This may be related to the level of block, and variation in the dose of drug used between different anaesthesiologists. In addition, use of nitroglycerine for tocolysis also could have contributed to hypotension. However, subsequently, there was no further incidence of hypotension during rest of the foetoscopic procedure. In previous study[12] in patients undergoing selective FLA, the incidence of maternal hypotension under epidural anaesthesia was 53.4% in the second trimester. However, there was no statistically significant correlation between intraoperative maternal hypotension and foetal outcome in their study.[12]

General anaesthesia has the advantage of increased ability of the patient to tolerate extreme positions and the surgical manipulations of the uterus which may be required in technically difficult cases. It also provides greater uterine relaxation.[5] General anaesthesia may be preferred in patients with anterior placenta, as these patients require extreme positions for trocar insertion.[5] However, use of drugs like sedatives analgesics and muscle relaxants has implication on foetal well-being. The patient should be positioned with left lateral tilt for left uterine displacement to prevent aortocaval compression, which may decrease venous return, resulting in decreased maternal cardiac output and low placental perfusion. Doses of anaesthetic agent should take into consideration the increased sensitivity of parturient for drugs. Foetal monitoring of heart rate is important as a direct evidence of the adequacy of foetal circulation. The foetal heart rate can be monitored during the procedure with ultrasound by the surgeon. Anaesthesia for foetal surgery involves coordination and communication between surgical and anaesthesia team and patient herself.[13]

The limitation of this retrospective analysis is that no uniform dose of drug was used for regional spinal anaesthesia as different anaesthesiologists used different dosages. In addition, nitroglycerine patch which was used to tocolysis also could have contributed to hypotension. This may have resulted in initial hypotension which was corrected with phenylephrine. However, we did not find any incidence of hypotension during rest of the procedure. Our experience with general anaesthesia has been limited to few cases, and hence comparison between the two techniques is not possible.

CONCLUSION

Multiple factors can influence the choice of anaesthesia, for foetoscopic procedures, such as the surgical procedure planned, pre-operative maternal history, history of previous uterine activity and the experience of surgeon for successful and good outcome. Anaesthesia for TTTS and TRAP may be undertaken under regional anaesthesia, even though general anaesthesia may be required in some cases.

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Conflicts of interest

There are no conflicts of interest.

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Announcement

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