

Anesthetic Techniques and Incidence of Complications in Fetoscopic Surgery

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Background: Nowadays, fetoscopic surgery has been accepted to be a procedure to correct numerous congenital anomalies. This operation can be successfully done under general, regional or local anesthesia with sedation. Incidence of complications from anesthesia in fetoscopic surgery has not been reported in Thailand.

Objective: To describe anesthetic techniques and incidence of complications in fetoscopic surgery.

Material and Method: Data of 152 pregnant women undergoing fetoscopic surgery in a single university hospital was retrospectively chart reviewed from June 2005 to November 2015. Patient characteristics, choices of anesthesia, medication used, intraoperative data and complications were collected.

Results: During the study period, spinal anesthesia was the most popular technique used in fetoscopic surgery (71%). Other anesthetic techniques used were general anesthesia with endotracheal tube (GA) (20.5%), epidural anesthesia (1.3%), combined spinal and epidural anesthesia (0.7%), failed spinal anesthesia converting to GA (2.6%) and local anesthesia with sedation (3.9%). Most frequent anesthetic-related complication was maternal hypotension which occurs in 115 out of 152 patients (75.6%). All of 5 cases (3.3%) of postoperative pulmonary edema received SA. Fetal death after operation was 25 in 152 records (16.4%). None of patients received GA experienced desaturation, pulmonary aspiration, failed intubation or pulmonary edema.

Conclusion: Spinal anesthesia (SA) is the most frequent technique used for fetoscopy, and hypotension is the most common complication. Since pulmonary edema was also found, judicious perioperative fluid management should be implemented to prevent postoperative pulmonary edema.

Keywords: Fetoscopic surgery, Twin-twin transfusion syndrome, Anesthetic techniques, Anesthetic complications

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Fetoscopic surgery has been acknowledged to be a reliable procedure to correct several congenital anomalies e.g. shunts insertion in fetal bladder outlet obstruction (BOO), laser ablation of vessels in twin-twin transfusion syndrome (TTTS), balloon occlusion in congenital diaphragmatic hernia (CDH) etc. This type of surgery is considered to be a minimally invasive surgery. The technique involves an introduction of small-caliber instruments into the amniotic cavity under ultrasound guidance⁽¹⁻⁴⁾. This procedure can be successfully done under a variety of anesthetic techniques, either general anesthesia (GA), regional anesthesia such as spinal anesthesia (SA) or epidural

anesthesia (EA) or local anesthesia (LA) with sedation⁽⁵⁻⁸⁾. Each technique has both advantages and drawbacks.

Several complications related to anesthetic after fetoscopic surgery can occur. For instance, pulmonary edema which may caused by volume overload, tocolytic used⁽⁹⁾ or irrigating fluid absorption⁽¹⁰⁾. Besides, maternal hypotension intra-operatively commonly arises from regional anesthesia⁽¹¹⁾. GA with endotracheal tube using inhaled anesthetic and opioid also brings about hypotension⁽⁶⁾; other airway related complication such as failed intubation, pulmonary aspiration and desaturation can occur.

The aim of the study is to report choice of anesthesia using in fetoscopic surgery in the tertiary care institute (Siriraj Hospital) and incidence of complications, which may relate to different anesthetic techniques.

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Material and Method

Conduct of the study was approved by the Siriraj Institutional Review Board, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand. The trial protocol was registered with www.clinicaltrials.gov (NCT02434926). This study is the retrospective chart review. An inclusion criterion was pregnant women undergoing fetoscopic surgery since June 2005 to November 2015. Patients who underwent fetoscopic surgery without anesthesia by anesthesiologist were excluded from this study. Demographic data including preoperative data: gestational age, diagnosis, type and dosage of tocolytic medication received, intra-operative data: choice of anesthesia, amount and types of anesthetic medication, vital signs intra-operatively, complications; and postoperative data complications at patients ward e.g. pulmonary edema or fetal death were collected. Hypotension was defined as systolic blood pressure <20% of preoperative blood pressure or <100 mmHg⁽¹²⁾. Maternal heart rate <50 beat per minute and/or receiving intravenous atropine was defined as bradycardia. Desaturation defined as oxygen saturation less than 95%. Patients experiencing desaturation detected by oxygen saturation <95% with abnormal lung signs e.g. rale or crepitation and/or radiographic evidence of pulmonary edema and/or postoperative treatment with diuretics were described as pulmonary edema⁽¹³⁾. Primary outcome of this study is to describe type of anesthetic techniques used in fetoscopic surgery. Secondary outcomes are the incidence of complications related with different anesthetic techniques.

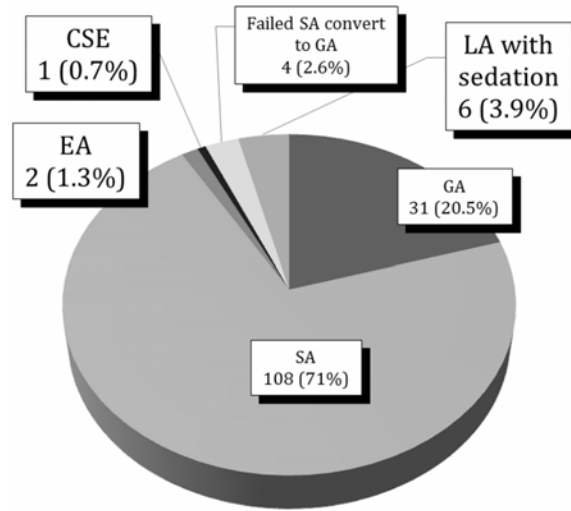
Statistical analysis

Sample size calculation was done by using 50.8% incidence of hypotension in patients receiving fetoscopic surgery (Ngamprasertwong et al)⁽¹⁴⁾. With the confidence level (1- α) of 95% and allowable error 0.08, two-sided test using formula $n = Z_{(1-\alpha)}^2 p(1-p)/d^2$, accordingly, 151 patients were required. All analyses were performed using PASW statistics (SPSS) version 18.0 (SPSS Inc., Chicago, IL, USA). Categorical data were presented as the number and proportion, expressed as a percentage. The Chi-squared test was used to analyze categorical data. Continuous data were reported as the mean \pm standard deviation or median with range. The *p*-values <0.05 were considered statistically significant.

Results

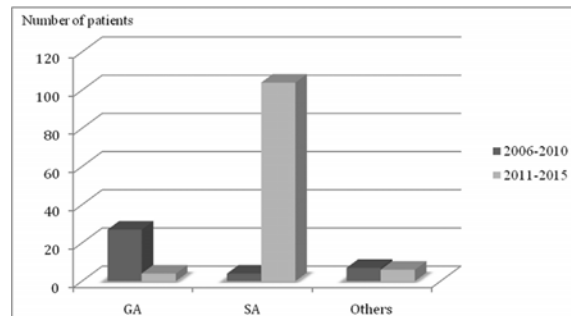
One hundred and fifty-two patients were

included in the study. Spinal anesthesia was the most common anesthetic technique used in fetoscopic surgery (71%). Different types of anesthetic technique used is shown in Fig. 1 which are general anesthesia with endotracheal tube (GA) (20.5%), epidural anesthesia (1.3%), combined spinal and epidural anesthesia (0.7%), failed spinal anesthesia converting to GA (2.6%) and local anesthesia with sedation (3.9%). Fig. 2 demonstrates anesthetic techniques divided by years. SA became more popular in the past 5 years



GA = general anesthesia; SA = spinal anesthesia; EA = epidural anesthesia; CSE = combined spinal and epidural anesthesia; LA = local anesthesia

Fig. 1 Anesthetic technique used in fetoscopic surgery, n (%) (total n = 152).



GA = general anesthesia; SA = spinal anesthesia
Others: epidural anesthesia, combined spinal and epidural anesthesia, failed spinal anesthesia convert to general anesthesia and local anesthesia with sedation

Fig. 2 Anesthetic technique used in fetoscopic surgery divided by years [total n = 152].

which probably due to a slight shorter operative time (56.2 ± 26.2 minutes in 2006-2010 compared with 51.7 ± 19.8 minutes in 2011 to 2015). The patients' demographic and clinical characteristics in different anesthetic techniques are shown in Table 1. Obstetric-related maternal comorbidity was found in 32 of 152 patients diagnosed preeclampsia. None of the patients was diagnosed of gestational diabetes or gestational hypertension. Intra-operative data is shown in Table 2. The most common anesthesia-related complication was maternal hypotension which occurred in 115 out of 152 patients accounting for 75.6%. Proportion of patients received general anesthesia experienced hypotension was significantly lower than those patients who received spinal anesthesia (38.7% and 87.9%, respectively), ($p < 0.001$). All patients underwent operation under spinal anesthesia received intravenous

vasopressor. None of patients who received GA experienced desaturation, pulmonary aspiration, failed intubation or pulmonary edema. None of patients who received spinal, epidural anesthesia or combined spinal and epidural anesthesia (CSE) experienced high spinal block, total spinal block or post dural puncture headache. Mean anesthetic level from SA was thoracic level 5.4 ± 2.2 with mean volume of 0.5% Hyperbaric bupivacaine of 2.4 ± 0.32 ml. Table 3 presents incidence of complications in postoperative period. Five patients experiencing pulmonary edema after fetoscopic surgery were described in detail in Table 4.

Discussion

This study showed that spinal anesthesia was the most popular anesthetic technique in patient undergoing fetoscopic surgery. Since fetoscopic

Table 1. Patients' clinical and demographic characteristics

	General anesthesia* n = 31	Spinal anesthesia n = 108	Others** n = 13
Age (years)	30.3±6.5	29.9±5.8	26.0±5.0
BMI (kg/m ²)	24.3±4.2	25±4.4	24.9±2.5
Gestational age (week)	21.6±3.3	21±2.7	24.2±4.0
Twin pregnancy	28 (90.30)	104 (96.30)	7 (53.83)
Triplet	-	1 (0.93)	-
Fetal diagnosis			
Twin-twin transfusion syndrome	28 (90.3)	105 (97.2)	7 (53.8)
Urinary bladder outlet obstruction	1 (3.2)	3 (2.8)	-
Congenital diaphragmatic hernia	2 (6.5)	-	1 (7.7)
Other***	-	-	5 (38.5)
Preoperative tocolytic drug, n (%)			
Nifedipine	20 (64.5)	90 (83.3)	6 (46.2)
Terbutaline	1 (3.2)	10 (17.6)	2 (15.4)
Magnesium sulfate	-	5 (4.6)	2 (15.4)
Average dosage of tocolytic drug			
Nifedipine (mg)	6.45±4.86	8.52±4.28	7.50±5.00
Terbutaline (mg)	0.24±1.34	0.91±2.28	0.62±1.25
Magnesium sulfate (g)	-	4.39±29.60	-
Placental site			
Anterior	9 (29.0)	40 (37.0)	7 (53.8)
Posterior	11 (35.5)	39 (36.1)	3 (23.1)
Not specify	11 (35.5)	29 (26.9)	3 (23.1)

Data presented in number (%) or mean ± SD

BMI = body mass index

* General anesthesia: general anesthesia with endotracheal tube in all patients

** Others: epidural anesthesia, combined spinal and epidural anesthesia, failed spinal anesthesia convert to general anesthesia and local anesthesia with sedation

*** Other diagnosis included TRAPS and fetal anomaly

Table 2. Intraoperative data

	General anesthesia n = 31	Spinal anesthesia n = 108	Others* n = 13
Baseline SBP (mmHg)	107.90±9.7	114.4±13.0	108.8±9.3
Baseline HR (mmHg)	87.00±18.1	86.7±16.2	97.3±15.1
Hypotension [†]	12 (38.7)	95 (87.9)	8 (61.5)
Episode of hypotension (times)	0.90±1.6	5.0±4.5	1.0±1.4
Bradycardia	1 (3.2)	3 (2.8)	0
Patients required intraoperative vasopressor	26 (83.8)	108 (100)	13 (100)
Intraop Ephedrine (mg)	6.20±7.3	18.2±15.0	9.5±5.3
Intraop Norepinephrine (mcg)	6.80±10	19.0± 25.5	36.5± 13.6
Number of patients required sedation	N/A	46 (42.6)	11 (84.6)
IV Fentanyl (mcg)	75 (0-125)	25 (0-100)	50 (50-175)
IV Miazolam (mg)	0 (0-2.5)	0 (0-5)	0 (0-10)
IV Pethidine(mg)	0 (0-50)	0 (0-50)	-
Fluid intake (ml)	817.74±358.0	960.0±418.0	1,164.0±539.0
Urine output (ml)	247.00±203.0	146.0±128.0	100.0±70.0
Operation time (min)	60.00±30.0	50.0±18.0	64.0±32.0
Anesthetic time (min)	98.00±30.0	93.0±21.0	106.0±31.0

Data presented in number (%), mean ± SD and median (min-max)

SBP = systolic blood pressure; HR = heart rate; IV = intravenous; N/A = non applicable

* Others: epidural anesthesia, combined spinal and epidural anesthesia, failed spinal anesthesia convert to general anesthesia and local anesthesia with sedation

[†] $p < 0.001$ comparing between general anesthesia and spinal anesthesia

Table 3. Postoperative data

	General anesthesia n = 31	Spinal anesthesia n = 108	Others* n = 13
Number of patients received postoperative tocolytic drug			
Nifedipine	22 (71.0)	91 (84.3)	7 (53.8)
Terbutaline	21 (67.7)	83 (76.9)	4 (30.8)
Magnesium sulfate	0	11 (10.2)	0
Postoperative tocolytic drug total dosage			
Nifedipine (mg)	68.39±60.44	102.80±197.75	40.00±56.56
Terbutaline (mg)	2.39±4.66	15.72±67.11	10.75±15.2
Magnesium sulfate (g)	0	24.16±100.92	0
Pulmonary edema	0	5 (4.6)	0
Fetal outcome: fetal death	5 (16.1)	18 (16.7)	2 (15.4)

Data presented in number (%) and mean ± SD

* Others: epidural anesthesia, combined spinal and epidural anesthesia, failed spinal anesthesia convert to general anesthesia and local anesthesia with sedation

surgery has been practiced in the author's institute from the past 10 years, nowadays, team experience in this procedure has been improved. Operative time may be the one possible factor influencing choice of

anesthesia even though average operative time from 2011 to 2015 was only slightly shorter than operative time from 2005 to 2010. From 2005 to 2010, the most common anesthetic technique was GA. After 2011,

Table 4. Description of patients experiencing pulmonary edema. All patients were diagnosed as placental transfusion syndrome and having fetoscopy with laser photocoagulation of vessels under spinal anesthesia

Age (years)	GA (weeks)	Co-morbidity	Diagnosis	Fluid balance	Onset of pulmonary edema/Clinical presentation	Treatment	Outcome
38	25	No	Placental transfusion syndromes stage III	- Preop: positive balance of fluid 2,660 ml - IV OR: 1,300 ml - EBL: minimal	POD 1 - Desaturation - Dyspnea - Orthopnea - Abnormal CXR	- Restrict fluid - Furosemide 20 mg iv - Discontinue Terbutaline - O ₂ mask - Restrict fluid - Furosemide 40 mg iv - Oseltamivir - Ceftriaxone - O ₂ mask - PRC transfusion 1 unit	Maternal: improved Both fetal death
25	20	Thyrototoxicosis, Anemia Hct = 27%	Placental transfusion syndromes stage II	- Preop: positive balance of fluid 600 ml - IV OR: 500 ml - EBL: minimal - Postop: positive balance of fluid 3,178 ml in 3 days	POD 3 - Desaturation - Low grade fever - Dyspnea - Cough - Orthopnea - Abnormal CXR	- Restrict fluid - Furosemide 40 mg iv - Oseltamivir - Ceftriaxone - O ₂ mask - PRC transfusion 1 unit	Differential diagnosis of pneumonia Maternal improved Both fetal viable
36	19	No	Placental transfusion syndromes stage II	- Preop: positive balance of fluid 600 ml - IV OR: 1,000 ml - EBL: minimal - Postop: positive balance of fluid 1,130 ml in 2 days	POD 2 - Desaturation - Dyspnea - Orthopnea - Crepitation both lungs - Abnormal CXR - Echo: Global hypokinesia, EF 48%	- Restrict fluid - Furosemide 140 mg iv - Enalapril orally - O ₂ Mask	Maternal: spontaneous abortion postop, pulmonary edema improved Both fetal death
34	23	Anemia Hct = 24%	Placental transfusion syndromes stage III	- Preop: positive balance of fluid 500 ml - IV OR: 1,300 ml - EBL: minimal - Postop: positive balance of fluid 3,357 ml in 2 days	POD 2 - Desaturation - Dyspnea - Crepitation both lungs - Abnormal CXR	- Off IV fluid - Off MgSO ₄ - Furosemide 20mg iv - O ₂ canula - PRC transfusion 1 unit	Maternal: improved One fetal death
36	24	No	Placental transfusion syndromes stage IV	- Preop: positive balance of fluid 1,630 ml in 2 days - IV OR: 700 ml - EBL: minimal	POD 1 - Desaturation - Dyspnea - Pink frothy sputum - Crepitation both lungs - Abnormal CXR	- Off IV fluid -O ₂ canula - Off MgSO ₄ - Furosemide 20 mg iv - Micronized progesterone vaginal suppository	Maternal improved Both fetal viable

GA = gestational age; Hct = hematocrit; Preop = preoperative; IV OR = intraoperative intravenous fluid; EBL = estimated blood loss; POD = postoperative day; PRC = packed red cells; MgSO₄ = magnesium sulfate

single shot spinal anesthesia became more common. Another factor that might have effects on choice of anesthesia in this procedure is the difficulty of surgical exposure such as location of the placenta, umbilical cord and amniotic membranes⁽¹¹⁾. However, placental site might not get involved with the choice of anesthesia in this study as shown in Table 1 that placental site is almost the same proportion in each anesthetic technique.

In patients with fetal diagnosis of CDH, general anesthesia was chosen by consultant anesthesiologists, as they might not be familiar with the surgical procedure of fetal endoscopic tracheal balloon occlusion in CDH compared to fetoscopic laser photocoagulation of vessels in TTTS. Moreover, it may be due to the fact that several advantages could be obtained from general anesthesia. First, general anesthesia provides maternal unconscious and comfortable. Second, achieving more uterine relaxation from general anesthesia compared to spinal anesthesia. That is, general anesthesia provides uterine relaxation and fetal immobilization by inhaled halogenated agents with intravenous opioids. Achieving maximal uterine relaxation derived from using inhaled agents as high as 2 MAC⁽⁵⁾. However, using high dosage of volatile anesthetic should be cause for concern because it can cause fetal myocardial depression and diminish fetal cardiac output⁽¹⁵⁾. A study from Rossi et al⁽⁶⁾ showed maternal blood pressure significantly decreased in those patients who received general anesthesia with endotracheal tube or total intravenous anesthesia (TIVA) with propofol compared to local anesthesia with conscious sedation in fetoscopic with laser photocoagulation surgery in TTTS. Therefore, providing general anesthesia should be done cautiously with maintaining maternal blood pressure to assure that there is an adequate fetal blood flow.

Maternal analgesia and fetal immobilization are necessary in fetoscopic surgery⁽¹⁶⁾. In regional anesthesia, fetal immobilization is not achieved. Intravenous opioids are selected to provide both maternal analgesia and fetal immobilization^(8,16). Van de Velde et al⁽⁸⁾, revealed that intravenous remifentanyl using group had lesser fetal motions and better facilitated surgical exposure than intravenous diazepam group. Nevertheless, since remifentanyl was not available in the author's institute during the study period, fentanyl, pethidine and other sedative drugs such as midazolam were administered for maternal analgesia, sedation and fetal immobility.

The most common anesthesia-related

complication was maternal hypotension accounting for 75.6%, most of which occur from spinal anesthesia causing vasodilatation from local anesthetic used⁽¹²⁾. Another plausible reason is that preoperative oral nifedipine-an antihypertensive drug used as a tocolytic drug might contribute to intraoperative maternal hypotension. However, study from Ngamprasertwong et al⁽¹⁴⁾ revealed no difference between patients who received nifedipine or not received nifedipine. An attempt of anesthesiologist to maintain maternal normotension in patients received RA might cause slightly greater volume of intravenous fluid administration compared to patients received GA. Intraoperative vasopressors were also used three times higher in patients receiving spinal anesthesia than those who received general anesthesia.

Incidence of serious complication such as postoperative pulmonary edema was 5 in 152 patients (3.3%). Positive fluid balance 1-5 liters before onset of pulmonary edema was found in all 5 patients. Large amount of intraoperative fluid administration in order to prevent or treat maternal hypotension caused pulmonary edema as seen in recent study from Duron et al⁽¹³⁾ who found higher incidence of postoperative pulmonary edema in patients having fetoscopy under GA and received intraoperative intravenous fluid intake 1,634±949 ml compared to 485±238 ml (5.5% and 0% respectively). There was one case report of maternal pulmonary edema resulted from absorption of 8 liters of irrigating fluid through myometrial venous channels accessed by passage of the operating trocar⁽¹⁰⁾. Because there was no record of intraoperative irrigation fluid amount in the medical records, the authors were not able to demonstrate the relationship of the amount of irrigation fluid and pulmonary edema. Hering et al⁽¹⁷⁾ study also showed moderately increasing in extravascular lung water content and pulmonary capillary permeability. Their study confirmed that these women are more prone to develop pulmonary edema. This can imply that fluid management in perioperative period plays an important role for this complication.

In addition to this, another important contributing factor of pulmonary edema is the use of tocolytic drug⁽⁹⁾. Common tocolytic drugs such as magnesium sulfate and beta-agonist, especially when using in combination of these drugs would increased more chance of developing pulmonary edema⁽⁹⁾. The authors found two out of five cases who developed pulmonary edema had received magnesium sulfate. After diagnosis, there was a change from magnesium sulfate to other tocolytic drug. Preoperative anemia

was found in two patients without a significant amount of intraoperative blood loss; both needed blood transfusion in postoperative period. Although preeclampsia is known as a contributing factor of maternal pulmonary edema⁽⁹⁾, there was no patient experiencing pulmonary edema in this study diagnosed this condition. Fetal death occurs in three out of five patients experiencing pulmonary edema. Although it could not be proved whether maternal hypoxia caused fetal death in this study, it was proved to have affects on fetal oxygenation which leads to fetal bradycardia and low ventricular output^(18,19).

Conclusion

This study demonstrated that spinal anesthesia was the most frequent choice of anesthesia. Different anesthetic techniques cause different rate of complications. The most common anesthetic-related complication was maternal hypotension, mostly occurred from spinal anesthesia. Anesthesiologists should be aware of any possible side effect that can occur as well as limit perioperative fluid volume administration in patients undergoing fetoscopic surgery in order to prevent pulmonary edema. A large randomized control study should be carried out to confirm maternal and fetal consequences of different anesthetic techniques in fetoscopic surgery.

What is already known on this topic?

Fetoscopic surgery is considered minimally invasive surgery involving both maternal and fetal physiology. This operation has been introduced into Thailand in the past decade. Wide range of anesthetic techniques namely general anesthesia, regional anesthesia or local anesthesia with sedation can be successfully implemented. Each anesthetic technique leads to different complications. Hypotension is the most common complication that can be found as high as 50.8-54.8%.

What this study adds?

This study revealed different anesthetic techniques and medications used in fetoscopic surgery in Thailand that has not yet been reported. Also, the authors report incidence of anesthesia-associated complications that occur in intraoperative and postoperative period. Maternal hypotension is the most common anesthesia-related complication, which accounted for 75.6%. Severe complication such as postoperative pulmonary edema was found at 3.3%.

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Register

ClinicalTrials.gov as NCT02434926

Potential conflicts of interest

None.

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การระงับความรู้สึกในผู้ป่วยที่มาเข้ารับการส่องกล้องเพื่อผ่าตัดทวารทวารอ่อนและอุบัติเหตุการเกิดภาวะแทรกซ้อน

พัชรียา นีวัฒนภูมิภัทร, ภาวิณี ปางทิพย์อำไพ, ธัชวรรณ จิระดิวานนท์, สุกัญญา เดชอาคม, น้ำทิพย์ ไครยสุนันท์, ธงชัย เต็มปีติกุล

ภูมิหลัง: ปัจจุบันมีการส่องกล้องเพื่อผ่าตัดแก้ไขความผิดปกติของทวารทวารอ่อนในศัลยกรรมรดา การผ่าตัดนี้สามารถทำภายใต้การระงับความรู้สึกแบบต่างๆ ได้แก่การระงับความรู้สึกแบบทั้งตัว การระงับความรู้สึกแบบเฉพาะส่วน หรือการระงับความรู้สึกด้วยยาเฉพาะที่ร่วมกับยานอนหลับ ซึ่งยังไม่เคยมีรายงานอุบัติการณ์ของภาวะแทรกซ้อนที่เกิดจากการระงับความรู้สึกในการผ่าตัดนี้ในประเทศไทย

วัตถุประสงค์: เพื่อศึกษาวิธีการระงับความรู้สึกในการส่องกล้องเพื่อผ่าตัดทวารทวารอ่อนและรายงานอุบัติการณ์ของภาวะแทรกซ้อนที่เกิดระหว่างและหลังผ่าตัด

วัสดุและวิธีการ: เก็บข้อมูลแบบย้อนหลังจากเวชระเบียนผู้ป่วยทั้งสิ้น 152 ราย ที่เข้ารับการผ่าตัดนี้ตั้งแต่เดือนมิถุนายน พ.ศ. 2548 ถึง พฤศจิกายน พ.ศ. 2558 เก็บข้อมูลลักษณะของผู้ป่วย การระงับความรู้สึกที่ได้รับ ยาที่ได้รับ ข้อมูลต่างๆ ระหว่างการผ่าตัดและภาวะแทรกซ้อนที่เกิดขึ้น

ผลการศึกษา: การระงับความรู้สึกเฉพาะส่วนทางช่องน้ำไขสันหลังเป็นที่นิยมมากที่สุดถึงร้อยละ 71 การระงับความรู้สึกแบบทั้งตัวร้อยละ 20.5 การระงับความรู้สึกทางช่องเหนือไขสันหลังร้อยละ 1.3 การระงับความรู้สึกทางช่องน้ำไขสันหลังและช่องเหนือไขสันหลังร้อยละ 0.7 การระงับความรู้สึกทางช่องน้ำไขสันหลังไม่สำเร็จต้องเปลี่ยนเป็นการระงับความรู้สึกแบบทั้งตัวร้อยละ 2.6 และการใช้ยาเฉพาะที่ร่วมกับยานอนหลับร้อยละ 3.9 ภาวะแทรกซ้อนที่พบบ่อยที่สุดคือความดันโลหิตต่ำซึ่งพบ 115 รายใน 152 รายคิดเป็นร้อยละ 75.6 ภาวะปอดบวมร้อยละ 3.3 ทุกรายได้รับการระงับความรู้สึกเฉพาะส่วนทางช่องน้ำไขสันหลัง ทารกในครรภ์เสียชีวิตหลังผ่าตัดพบได้ร้อยละ 16.4 ไม่มีผู้ป่วยที่ได้รับการระงับความรู้สึกแบบทั้งตัว มีภาวะแทรกซ้อนจากระบบทางเดินหายใจ

สรุป: การระงับความรู้สึกเพื่อผ่าตัดทวารทวารอ่อนในครรภ์ ส่วนใหญ่ใช้วิธีการให้ยาทางช่องน้ำไขสันหลัง ภาวะแทรกซ้อนที่พบบ่อยคือความดันโลหิตต่ำรวมทั้งอาจเกิดภาวะปอดบวมได้ จึงควรระมัดระวังการให้สารน้ำในผู้ป่วยกลุ่มนี้
