



## Original Contribution

# Postpartum tubal ligation: A retrospective review of anesthetic management at a single institution and a practice survey of academic institutions

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## ABSTRACT

**Study objective:** The primary aim was to evaluate institutional anesthetic techniques utilized for postpartum tubal ligation (PPTL). Secondly, academic institutions were surveyed on their clinical practice for PPTL.

**Design:** An institutional-specific retrospective review of patients with ICD-9 procedure codes for PPTL over a 2-year period was conducted. Obstetric anesthesia fellowship directors were surveyed on anesthetic management of PPTL.

**Setting:** Labor and delivery unit. Internet survey.

**Patients:** 202 PPTL procedures were reviewed. 47 institutions were surveyed; 26 responses were received.

**Measurements:** Timing of PPTL, anesthetic management, postoperative pain and length of stay.

**Main results:** There was an epidural catheter reactivation failure rate of 26% (18/69 epidural catheter reactivation attempts). Time from epidural catheter insertion to PPTL was a significant factor associated with failure: median [IQR; range] time for successful versus failed epidural catheter reactivation was 17 h [10–25; 3–55] and 28 h [14–33; 5–42], respectively ( $P = 0.028$ ). Epidural catheter reactivation failure led to significantly longer times to provide surgical anesthesia than successful epidural catheter reactivation or primary spinal technique: median [IQR] 41 min [33–54] versus 15 min [12–21] and 19 min [15–24], respectively ( $P < 0.0001$ ). Fifty-eight percent (15/26) of respondents routinely leave the labor epidural catheter in-situ if PPTL is planned. Sixty-five percent (17/26) and 7% (2/26) would not attempt to reactivate the epidural catheter for PPTL if  $> 8$  h and  $> 24$  h post-delivery, respectively.

**Conclusions:** Epidural catheter reactivation failure increases with longer intervals between catheter placement and PPTL. Failed epidural catheter reactivation increases anesthetic and operating room times. Our results and the significant variability in practice from our survey suggest recommendations on the timing and anesthetic management are needed to reduce unfulfilled PPTL procedures.

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## 1. Introduction

Tubal sterilization is one of the most common forms of contraception in the United States (US) and is frequently performed in the early postpartum period [1]. The American College of Obstetricians and Gynecologists (ACOG) emphasize a postpartum tubal ligation (PPTL) should be considered an *urgent* procedure and performed in the early postpartum period [2]. PPTL is considered urgent due to the limited time frame

in which the procedure can be completed and the individual and societal impacts of unfulfilled PPTL procedures [3–5]. Recent practice guidelines for obstetric anesthesia fail to address the urgency recommended by ACOG [6]. In a recent review of PPTL in the US, Richardson et al. emphasized the urgency of PPTL and for anesthesiologists to consider not only their role in providing safe anesthetic care but challenged providers to engage with obstetricians and staff to reduce the rate of unfulfilled PPTL [7].

Various anesthetic techniques for PPTL are utilized in clinical practice, and there is limited data regarding the optimal anesthetic technique and clinical practice in the US [6,8–13]. The majority of women undergoing labor in the US will request and receive epidural analgesia [13]. Therefore, in the early postpartum period, a labor epidural catheter is often in-situ and available to provide surgical anesthesia for PPTL. Previous studies have shown variable success when attempting to

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use a pre-existing labor epidural catheter to initiate anesthesia for PPTL [10–12,14]. Reliable predictors for successful reactivation of labor epidural catheters have not been determined [10,12,14]. Spinal, epidural and general anesthesia (GA) are all utilized for provision of anesthesia for PPTL but have not been comparatively evaluated.

The primary aim of the study was to review anesthetic techniques utilized for PPTL at our institution over a two-year period to determine the rate of successful epidural catheter reactivation, characteristics associated with successful reactivation of pre-existing labor epidural catheters, and compare intraoperative times and immediate postoperative outcomes of different anesthetic techniques. The secondary aim of the study was to survey preferred anesthetic management and timing of PPTL at academic centers with obstetric anesthesia fellowship programs to assess practices amongst different institutions.

## 2. Methods

Stanford University Institutional Review Board approval was obtained.

### 2.1. Retrospective analysis of institutional practice

A retrospective chart review of all patients who underwent a PPTL at Lucile Packard Children's Hospital (LPCH), Stanford, over a 2-year period (August 2012–July 2014) was conducted. Patients were identified using International Classification of Diseases (ICD)-9 Procedure (PCS) Codes for tubal ligation status. An ICD-9-PCS Code search was performed on all hospital admissions between August 2012–July 2014 using ICD-9-PCS Codes 66\*. All records were then reviewed to determine if they met inclusion criteria. All open PPTL performed as a separate procedure during a postpartum hospital stay were included; tubal ligations performed at the time of cesarean delivery or as an elective procedure after hospital discharge were excluded. During the 2-year study period, the annual delivery rate at LPCH was an average of 4400 deliveries/year with a mean labor epidural analgesia rate of 83%. Data collected included: demographic and obstetric characteristics, method of labor analgesia, timing of PPTL, anesthetic management for PPTL, postpartum and postoperative pain scores, and analgesic usage. Pain scores are reported using a numerical verbal pain score (VPS, 0 = no pain and 10 = worst pain imaginable). Data were collected by two investigators (SA and CPM) and verified by a single investigator (CPM).

Women were categorized into three groups: NA = epidural catheter reactivation not attempted (no epidural catheter in place or provider did not dose the epidural catheter for PPTL); SUC = successful epidural catheter reactivation; UNS = unsuccessful epidural catheter reactivation. Unsuccessful epidural catheter reactivation was defined as any dosing of an existing labor epidural catheter that subsequently required a secondary anesthetic technique for completion of PPTL. The success rates for time intervals ( $\leq 24$  h vs.  $>24$  h, and 0–2 h vs. 2–8 h vs. 8–12 h vs. 12–24 h vs.  $>24$  h) after labor epidural catheter insertion and delivery were compared to assess the optimal dosing interval for successful epidural catheter reactivation. SUC and UNS groups were compared to identify factors (age, body mass index (BMI), race, parity, depth of epidural space, catheter insertion depth, labor epidural vs. combined spinal-epidural (CSE), pain scores following epidural catheter placement, need for epidural catheter top-up, time since delivery, time since epidural catheter insertion, time of day of epidural catheter placement, and obstetric vs. general anesthesiologist) associated with successful reactivation. Neuraxial labor analgesia at our institution is initiated with either an epidural or CSE technique using a 17-gauge Tuohy needle; 26-gauge Gertie Marx spinal needle, if applicable; and a single orifice 19-gauge Perifix® FX spring-wound epidural catheter (BBraun, Bethlehem, PA). Catheters are typically secured at a depth of 5 cm in the epidural space with an adhesive transparent dressing.

Pharmacy-prepared syringes containing lidocaine 2%, epinephrine (1:200,000), and bicarbonate are standardly used to provide surgical

anesthesia for PPTL when epidural catheter reactivation is attempted. If spinal anesthesia is performed with a single-shot injection or CSE technique, intrathecal hyperbaric bupivacaine is administered. The decision of which intrathecal hydrophobic opioid (fentanyl or sufentanil) to administer is provider dependent. Hydrophilic opioids (morphine or hydromorphone) are not administered for PPTL at our institution.

The three groups (NA, SUC, and UNS) were compared for total anesthetic induction time defined as the time from “in room” to “anesthesia attained”. These times are charted as a required component of our electronic anesthetic record. “In-room” was defined as the time the patient enters the operating room (OR). “Anesthesia attained” was defined as the time at which an adequate level of surgical anesthesia (defined as a sensory blockade to pinprick above a T6 level bilaterally) has been achieved to proceed with PPTL under neuraxial anesthesia. For PPTL under GA, “anesthesia attained” was defined as the time the patient has been successfully induced and intubated. All women were divided into groups based on final anesthetic technique: spinal or CSE, successful labor epidural catheter reactivation, or GA. The different anesthetic techniques were analyzed to compare immediate postoperative outcomes including post-anesthesia care unit (PACU) length of stay (LOS), PACU pain scores, postoperative pain scores, postoperative opioid use, and hospital LOS.

### 2.2. Survey of academic institutions' clinical practice

Contact details of the forty-seven obstetric anesthesia fellowship directors (or appointed official) were obtained from the Society for Obstetric Anesthesia and Perinatology's online directory of fellowship programs in the US. An online survey was created using SurveyMonkey® (SurveyMonkey, Palo Alto, CA) and an e-mail was sent to invited participants in January 2015 (Appendix A). The e-mail explained the purpose of the survey and contained a link to the online survey. Consent was implied by completion of the survey and responses were collected anonymously. Three subsequent reminder e-mails were sent at two-weekly intervals.

Three fellowship-trained obstetric anesthesiologists created the survey, which comprised of 19 questions focusing on timing of PPTL, perioperative anesthetic management, and postoperative analgesia (Appendix A). The survey was tested for understandability using a cohort of three non-specialist anesthesiologists unfamiliar with the study. The survey obtained basic demographic information for the respondent's institution, which included annual delivery rate, cesarean delivery rate, and labor epidural rate. The remaining questions related to anesthetic practice and analgesic management for PPTL (Appendix A).

### 2.3. Statistical analysis

Descriptive statistics were used to summarize survey and institutional practice data. Results are expressed as mean  $\pm$  standard deviation, median [interquartile range; range], and number (percentage) as appropriate. Characteristics of women who had successful compared to failed epidural catheter reactivation were compared using Student's *t*-test for normally distributed data, Mann-Whitney *U* tests for continuous data, and chi-squared test for categorical data. Statistical analyses were performed with SPSS 22.0 statistical package (SPSS Inc., Chicago, IL) and Microsoft Excel (Microsoft Corp., Redmond, WA).  $P < 0.05$  was considered statistically significant.

## 3. Results

### 3.1. Retrospective analysis of institutional practice

The ICD-9-PCS Code search retrieved 502 patients and 202 patients met the study criteria for PPTL following vaginal delivery. A flow diagram of anesthetic management for all PPTLs performed during the

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