Training Veterinary Students to Perform Ovariectomy Using theMOOSE Spay Model With Traditional Method Versus the Dowling Spay Retractor™

Maria Fahie[1], DVM, MS, DACVS, Amanda Cloke[1], VM4, BS, Minette Lagman[2], BS, MS, Ohad Levi[1], DVM, Peggy Schmidt[1], DVM, MS, DACVPM

1. Western University of Health Sciences, College of Veterinary Medicine, Pomona, CA
2. Western University of Health Sciences College of Osteopathic Medicine, Pomona, CA

Author Information

Maria Fahie, DVM, MS, Diplomate ACVS, is a Professor in Small Animal Surgery, College of Veterinary Medicine, Western University of Health Sciences, 309 E Second Street, Pomona, CA 91766. Her areas of research are surgical skills training and clinical small animal surgery. mfahie@westernu.edu

Amanda Cloke is a fourth-year student at the College of Veterinary Medicine, Western University of Health Sciences, Pomona, CA 91766.

Minette Lagman, BS, MS, is a student at Touro College of Osteopathic Medicine, New York. At the time of the study she was a research assistant at the College of Osteopathic Medicine, Western University of Health Sciences, Pomona, CA 91766.

Ohad Levi, DVM, is an Associate Professor in Equine Surgery, College of Veterinary Medicine, Western University of Health Sciences, Pomona, CA 91766. His area of research is surgery education and simulation laparoscopic training in veterinary medicine.

Peggy Schmidt DVM, MS, Diplomate ACVPM is an Associate Professor, Population Health and Epidemiology, and Director of College Outcomes Assessment, College of Veterinary Medicine, Western University of Health Sciences, Pomona, CA 91766. Her area of research is educational methods and outcomes assessment in veterinary medicine.

Abstract

Educators understand the importance of developing safe and effective methods to teach veterinary students basic surgical skills. Ovariectomy (OVE) is a procedure that employs many of the skills agreed to be vital for a newly graduated veterinarian. This study endeavored to compare two methods to teach ovariectomy on a model based on assessment of procedure time and skill performance scores. Students' opinions regarding their experience are also reported. Students performed the Dowling Spay Retractor™ (DSR) method more quickly ($p<0.001$) but with similar performance scores compared to the Traditional (T) method depicted in textbooks. Students responded positively when surveyed regarding their experience with the training and the DSR method.

Keywords: ovariectomy training; Dowling Spay Retractor™; surgical education; surgical skill scoring, surgical model

Abbreviations:

Dowling Spay Retractor™ (DSR)

Traditional (T)

Ovariectomy (OVE)

Ovariohysterectomy (OVH)

Introduction

As educators, we are responsible for facilitating a positive, low-intensity learning environment that will maximize student skill mastery while minimizing student anxiety.[1,2] Students practice skills on models to enhance confidence prior to working with live patients. Developing models and validating assessment methods for common surgical procedures is important scholarly activity. General practitioners and veterinary surgeons have been surveyed to determine expectations in surgical skill proficiency of new graduate veterinarians.[3,4] Survey results indicated a broad consensus independent of demographic characteristics of the respondents. There were five general categories that at least two-thirds of respondents considered to be important for new graduates to have complete skill mastery. Those included aseptic technique (patient, procedure, environment), instrument / suture handling and knowledge, tissue handling, hemostasis, and dissecting / closing / ligating soft tissues. Ovariectomy (OVE) is a procedure that involves mastery of many of those skills and is increasingly reported as a safe procedure for sterilization of female dogs and cats, whether performed via laparotomy or laparoscopy.[5-10]

Surgical textbooks most commonly depict ovariohysterectomy (OVH) and most often using the 3 clamp method with Rochester-Carmalt forceps, retracting the ovarian pedicle tissue to be ligated.[11-13] This study therefore refers to that technique as the Traditional (T) method. The OVE procedure and the Dowling Spay Retractor™ (DSR; Figure 1)[a] are not typically depicted in textbooks. The DSR method entails fewer procedural steps compared with the T method since a single instrument is used to retract the ovarian pedicle tissue to be ligated. The DSR is a straight Kelly hemostatic forcep with a tapered socket at the box of the instrument which fits the detachable tapered foot. For OE, the reproductive tract tissue is exposed similarly to the

traditional method, with a window created in the mesometrium to allow for ovarian pedicle ligation. The DSR is placed within the window and clamped at the level of the proper ligament in one step, with the foot extending down to the outside of the abdominal incision, displaying the tissue to be ligated. No additional clamps are required.

It is well documented that using models for surgical skill training is equivalent or even superior to the use of live animals.[14] A recent study reported the positive impact of including a model developed in conjunction with an outside model making company into their curriculum.[15] Our study employed theMOOSE model[b] (Figure 2), which is currently used in our third year surgery course for surgical skill assessment. Since our study was completed, there has been one published article assessing a simple spay model and its positive impact on student skill development.[16] The surgical skills performance scoring rubric used in this study was developed based on a report of assessment of surgical skills specific to ovariohysterectomy on a model made within their college.[17] Recently, that scoring method was again referred to in development of a scoring system for assessing students' skills performing laparoscopic OVE, increasing its validity.[18]

The goal of this study was to compare the performance and time of veterinary students using two different training techniques for OVE. We hypothesized that students would perform OVE more quickly and with higher performance scores, preparedness and satisfaction using the DSR versus T method. Second year students, exposed to an additional year of clinical skills training in our curriculum, might perform significantly differently from first year students.

Materials and Methods

Study design

This was an observational, prospective, cross-over, cohort study. Western University of Health Sciences Institutional Review Board for the protection of human subjects approval of the study protocol was achieved (14/IRB/033).

Sample Population

Sample size was determined using anticipated study scores and times based on the author's (MF) experience with third year students performing similar tasks. Score projections considered a potential increase of 20 points in the DSR group based on potential improvement in instrument and tissue handling scores. Time projections considered a potential 5 minute time difference based on observation of students performing the two techniques on live patients in our third year surgery course. A sample size of 15 in each group (30 total) was considered enough for statistical significance to be achieved at a power of 0.8 and alpha of 0.05. Inclusion criteria were solely no prior experience with use of the Dowling Spay Retractor™ (Figure 1) or theMOOSE spay model (Figure 2). Participants were recruited using an email sent to all enrolled first and second year students 4 months before the study, inviting them to participate at the end of the semester, and providing details of the commitment required. Participants were randomly assigned so that about half (whether first or second year) would perform the ovariectomy procedure with the Dowling Spay Retractor™ (DSR) first and the remainder the traditional method (T) first based on the order they volunteered for the study.

Training

All students completed practical skills relevant to this study in laboratory sessions on models as part of their Veterinary Basic Clinical Skills course prior to study participation. First year students completed 6 hours and second year students completed 4 hours in their first year and 7 hours in their second year for a total of 11 hours.

All students attended a training session allowing them to practice each technique and receive verbal and hands-on feedback from the author (MF). Students had unlimited access to view online videos produced by the author (MF), demonstrating the expectations for each procedure as detailed in the scoring rubric (Table 1). Criteria to achieve proficient, competent, novice or unacceptable scores were discussed and demonstrated.

Procedure

Ovariectomy was performed on theMOOSE model including only the retrieval of the model reproductive tract, and ligation of all necessary structures to remove both ovaries. The traditional (T) method was performed using one mosquito hemostat on the proper ligament and two Rochester-Carmalt forceps on the ovarian pedicle in order to keep the necessary tissue exposed. The Dowling Spay Retractor™ (DSR) method requires only that instrument for exposure of tissues to ligate. Students placed two encircling / circumferential ligatures with 3-0 monofilament absorbable suture material[c] on the ovarian pedicle and on the uterine horn adjacent to the proper ligament, and then excised the segment of tissue between the ligatures containing the ovary. Students performed either the DSR or T technique first, then theMOOSE model was re-staged and they immediately performed the other technique.

Timing and Scoring

Table 1 depicts the scoring rubric employed in the study. Prior to study scoring, the authors (MF and AC) practiced scoring other videos to discover potential issues that might cause discrepancies and to establish consistency between the scoring levels. During the study, the students' hands and models were videotaped performing each procedure and the recordings were scored by the two blinded authors (MF and AC) at the completion of the study. The scoring rubric separated the procedure into 4 sections (first ovarian pedicle, first uterine horn, second ovarian pedicle, second uterine horn) and focused on the same 6 skills for each procedural step (appropriate site of clamp placement based on anatomy knowledge, instrument handling, tissue handling, appropriate site of ligature placement, appropriate technique of ligature placement, and ligature security). Students were awarded 10 points in each skill for proficient performance, 8 for competent performance, 6 for novice performance, and 0 for unacceptable performance as further defined in the rubric. Maximum possible score was 240 points from each scoring author. To document procedure time, a timer was initiated and stopped by the student participant at the beginning and end of each procedure. There was no imposed time limit to complete the procedure.

Time Performance Ratio

Time and score data was also analyzed to determine whether the second procedure performed by a student was faster or better simply because of the additional experience of having completed the first procedure. To evaluate the effect of the order the two procedures were performed, a time performance ratio was developed utilizing the traditional method as a benchmark:

$$\frac{\text{Time to perform traditional method} - \text{time to perform Dowling method}}{\text{Time to perform traditional method}}$$

The formula represents the proportion or percentage reduction in baseline performance time with the DSR method. This would be the percentage of "time savings" for students when they perform the DSR method.

Survey

At the end of the study, all 30 participants completed an online survey (Table 2) that subjectively assessed their experiences. Survey questions queried students regarding their level of agreement or disagreement with statements regarding training, the T method, the DSR method and theMOOSE model on a 5 point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree). The survey did not collect information regarding any additional hands on skill experience an individual student might have had prior to study participation.

Statistical Analysis

Data was analyzed using software SAS Enterprise Guide 4.3[d] . Time and scores (sum of MF and AC scores) were tested for normality to select appropriate statistical methods. Inter-rater reliability of MF and AC was determined using Spearman Correlation Coefficients for non-parametric data. Time and scores of T and DSR training methods were compared between 1st year and 2nd year students. Overall time and scores, regardless of training method, were also compared between 1st year and 2nd year students to determine if 2nd year students outperformed 1st year students regardless of training method. Statistical differences between 1st and 2nd year students were determined using a non-parametric one-way ANOVA with a Kruskal-Wallis Test on the resulting Wilcoxon Scores. Within student differences in times and scores of T and DSR

194 training methods were determined using the non-parametric Wilcoxon Signed Rank Test for
195 dependent samples. P-values less than 0.05 were considered significant for all analyses.
196
197 **Results**
198 *Sample Population*
199 More than 30 interested students were accepted in the order they replied. By the time of the
200 study, several students had to decline participation for various reasons, including altered travel
201 plans or summer employment, resulting in a final count of 13 first and 17 second year
202 participants. Additionally, one second year student's video recording faltered during the second
203 procedure, affecting scoring capability, so those scoring results were not included, leaving 16
204 second year participants. Thirteen students performed the DSR method first and of those, 4 were
205 1st year and 9 were 2nd year. Sixteen students performed the T method first and of those 9 were
206 1st year and 7 were 2nd year. All 30 students completed the anonymous survey after the study and
207 are included in the results.
208
209 *Performance Scores*
210 Data is reported as minimum, maximum, and median values of scores. Scores are reported as the
211 sum of scores from MF and AC (240 points each, maximum of 480 points) (Table 3). Inter-rater
212 reliability between MF and AC was considered adequate with no significant difference between
213 authors' scoring results ($p<0.0001$). Scores for the T method did not differ between 1st year and
214 2nd year students ($p=0.76$) with median values for 1st year students of 464 (range: 426-480) and
215 2nd year students of 462 (range: 368-480). Scores for the DSR method also did not differ
216 statistically between 1st and 2nd year students ($p=0.58$) with a median value for 1st year students

of 468 (range: 418-472) and 2nd year students of 469 (range: 384-480). For both T and DSR methods, 2nd year students had a broader range of score values than 1st year students. There was no difference in scores of the T method compared to the DSR method within either 1st year students (p=0.30) or 2nd year students (p=0.39).

Procedure time

Data is reported as minimum, maximum, and median values of times in seconds (Table 4). For the 1st year students, 5 of the 13 participants (38.5%) were faster on the second procedure and they all performed the DSR method second. For 2nd year students, 8 of the 16 participants (50%) were faster on the second procedure, and they all performed the DSR method second. Two students had faster times with the traditional method. Only one of the two performed the traditional method first. Regardless of the order of training, students performed the DSR procedure faster than the traditional procedure. Times for the T method did not differ between 1st year and 2nd year students (p=0.96) with median times of 665 seconds for 1st year students (range: 492-872) and 683.5 seconds for 2nd year students seconds (range: 480-1114). Times for the DSR method also did not differ statistically between 1st and 2nd year students (p=0.66) with median times for 1st year students of 511 seconds (range: 436-718) and 2nd year students of 500 seconds (range: 401-833). For both T and DSR methods, 2nd year students had a broader range of times than 1st year students. There was a statistical difference in times for the T method of training compared to the DSR method within 1st year students (p=0.0012) and within 2nd year students (p<0.0001) with the T method taking longer to perform than the DSR method.

Time Performance Ratio

The time performance ratio was statistically different between training ordered groups (p=0.011) (Table 5). The time for completion (Time T and Time D) did not statistically differ between training ordered groups (Time T p=0.96; Time D p=0.12). This pattern remained within each class (Time T 2nd year, p=0.87; Time T 1st year, p=0.76; Time D 2nd year, p=0.17; Time D 1st year, p=0.64) (Table 6). For training ordered groups, students performing the T method first (T1), did not differ statistically from students performing the DSR method first (D1) with regard to the time to complete either procedure (Time T p=0.96; Time D p=0.12). Within classes, 1st or 2nd year, this trend holds true (Time T 2nd year, p=0.87; Time T 1st year, p=0.76; Time D 2nd year, p=0.17; Time D 1st year, p=0.64).

For training ordered groups, students performing the T method first (T1), did differ statistically from students performing the DSR method first (D1) with regard to the score received for either procedure (Score T, p=0.03; Score D, p=0.05) (Table 7). Students in the T1 group had higher scores on both the T and DSR method compared with the D1 group. Looking at this trend within the classes, the score of the T method was only significantly different for the 2nd year students (Score T 2nd year, p=0.02) with students in the T1 group receiving higher scores. The score for the DSR method approached statistical significance in the 2nd year students (Score D 2nd year, p=0.07). No difference in scores between ordered groups was noted in the 1st year students (Score T 1st year, p=0.58.; Score D 1st year, p=0.28), however, only four 1st year students were in the D1 group and nine students were in the T1 group. Type II error may have contributed to the lack of statistical significance in procedure scores of 1st year students.

Student Survey

Results are summarized in Table 2. The vast majority (96.7%) of participants strongly agreed or agreed that the training videos and training day experience were beneficial to their skills development. With regard to procedural preference, 67% of participants disagreed or strongly disagreed with the statement that they prefer the T method. Ninety percent strongly agreed or agreed that the DSR provided better exposure of the ovarian pedicle for ligation and 100% strongly agreed or agreed that fewer procedural steps are required compared to T method. Twenty-six students (86.7%) agreed or strongly agreed that the DSR seemed to induce less potential tissue trauma. Seventy-five percent agreed or strongly agreed that using the DSR boosted their confidence in skills necessary to perform ovariectomy. Half of the participants agreed or strongly agreed that theMOOSE model was a realistic simulated patient. The other half were neutral or disagreed with that statement.

Discussion

This study compared performance scores and time between student groups performing ovariectomy with two different methods. Both first and second year students' median performance scores were proficient in both procedures. Scores were not significantly different between groups or student years as hypothesized, but the DSR method was significantly faster. Students' attitudes toward the DSR method were overwhelmingly positive on the survey.

Sample Population

We believe the training methods used in the study and in the students' prior skills curriculum have been successful based on those scores. Skills training practice time and video viewing is

not tracked in our curriculum or in this study, and undoubtedly some students spend more time practicing and watching videos than others. When recruiting study participants, we expect a population composed of both well-practiced, proficient students who seek every opportunity to be involved in surgery as well as those who are less proficient and seeking extra practice time with feedback to enhance their skills. This variability in participants may explain the larger standard deviation in second year student scores and times. In retrospect, a survey question regarding incentive for study participation may have provided additional information for data analysis. Alternatively, students' skills could have been surveyed and or assessed prior to initiating the study, and groups could have been formed based on technical skill level rather than year of the curriculum.

Performance Scores

The adequate inter-rater reliability in scoring indicates our rubric was consistent in application with minimal training since the second year student (AC) scored similarly to the ACVS board certified surgeon (MF). The subjective measurement of performance scoring can be challenging. The more detailed and specific the scoring rubric, the more useful it can be both for student feedback to enhance skill development, and for research purposes. Our scoring rubric focused on six main skills in each of the 4 main procedural steps. Of those six skills, three were directly related to instrument and tissue handling which involve the primary differences between the DSR and T methods. The DSR method, requiring placement of only one instrument to expose and retract the tissue for ligation, inherently requires less tissue and instrument handling compared with the T method. In retrospect, a more specific rubric emphasizing time and motion, and flow of operation, as in the well-validated Objective Structured Assessment of Technical

Skill (OSATS) global rating scale, may have facilitated statistical significance in scoring between procedures.[19] Additionally, since our study was performed, more recent research indicates that a six category Likert scale (1=unsatisfactory, 3=satisfactory, 6=excellent) is preferable for more accurate scoring and student feedback compared to the four category scale we used (proficient, competent, novice, unacceptable).[20]

Procedure time

The objective measurement of time is not challenging to record or analyze. Since the DSR method entails fewer procedural steps, it is not surprising that it was significantly faster. The speed of the procedure is significant not because we are encouraging students to perform quickly at this early stage in skill development, but rather to emphasize that with fewer steps to remember, students' anxiety in performing the procedure may be reduced. Survey results are supportive of that statement, although they are subjective in nature and the survey is not validated. Clinically, the DSR method is cost-effective and can be applied to both OVE and OVH to facilitate exposure and retraction of the ovarian pedicle for ligation with fewer procedural steps and without disruption of the suspensory ligament resulting in shorter procedure times with fewer potential adverse events.

Time Performance Ratio

To avoid type II error in analysis of these results, the random assignment of students to which procedure they would perform first should have also taken their class into consideration. Despite that, it is interesting to note that only second year students performing the T method first scored

better on both of their procedures. Perhaps this was related to their increased exposure to and familiarity with the T method during curricular clinical skills training.

Student Survey

Students' attitudes toward a learning experience are often researched using Likert scale questionnaires or surveys. Optimal survey design facilitates reliability in results.[21-23] Student ratings are usually quite reliable, reasonably valid and relatively uncontaminated by potential bias. In a review of literature on obtaining student feedback, an ideal questionnaire was considered to be a 5 point Likert scale asking students to agree or disagree with statements that are approximately half positively worded and half negatively worded to avoid acquiescence bias of a respondent that might simply agree or disagree with every statement.[22,23] Our study used a 5-point Likert scale but only with anticipated positively worded questions comparing the DSR and T methods, which may have compromised validity. Although, 66.6% of students disagreed or strongly disagreed with the statement, "I preferred the traditional method to perform OVE on the model", effectively making it turn out to be a negative question. The relative simplicity of the DSR method likely explains their responses despite the fact that most students are more familiar with the T method since it is depicted in textbooks and regularly observed in practice.

In conclusion, we were able to confirm our hypothesis that students would perform OVE more quickly with the DSR method, however lack of specificity in our performance scoring rubric challenged our ability to demonstrate statistically significant score differences between methods. Second year students did not perform better than first year students, but did have a larger standard deviation in median scores and times that we attributed to differences in experience

353 level and motivation of student volunteers at that stage in their curriculum. These findings
354 suggest that the training and evaluation methods used in the study were successful for students to
355 develop proficiency in performing OVE on a model with the DSR or T method. The DSR
356 method should be considered a valid technique for training students and enhancing skills
357 confidence.
358
359 **Notes**
360 [a] *Dowling Spay Retractor: Making Solo Spays Easy & Safe*. <http://spayretractor.com>.
361 Accessed 8/8/15.
362
363 [b] *theMOOSE Spay Model*. <http://mooseworksllc.com>. Accessed 8/8/15. MooseWorks LLC.
364
365 [c] 3-0 Monocryl®, poliglecaprone 25, Ethicon, U.S., LLC
366 [d] SAS Institute Inc., Cary, NC, USA
367
368 **Figure Legend**
369 Figure 1- Assembled Dowling Spay Retractor™ with large foot and lard guard in place. Small
370 foot and spare lard guard also shown disassembled.
371
372 Figure 2- theMOOSE spay model depicted as used in this study to mimic the ovariectomy
373 procedure using the Dowling Spay Retractor™ method.
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