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AUTHORS: Kelly L. Bowlt Blacklock, Pierre Langer, **Zoe Halfacree**, Donald A. Yool, Sandra Corr, Laura Owen, Ed Friend, Abel Ekiri

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# Canine Ovariohysterectomy: A Survey of Surgeon Concerns and Surgical Complications Encountered by Newly Graduated Veterinarians

Kelly L. Bowlt Blacklock ■ Pierre Langer ■ Zoe Halfacree ■  
Donald A. Yool ■ Sandra Corr ■ Laura Owen ■ Ed Friend ■  
Abel Ekiri

## Abstract

The objective of this study was to document newly qualified veterinarians' concerns and surgical complications encountered during canine ovariohysterectomy (cOVH) during the first year of general practice. A questionnaire investigating concerns about cOVH procedures was sent to all final-year veterinary students (group 1) enrolled at five UK universities. Participants were later asked to complete a similar questionnaire 6 months (group 2) and 12 months (group 3) after graduation, which involved prospectively grading their concern about different aspects of the cOVH procedure and reporting surgical complications encountered during three cOVHs. Responses were compared between different time points.

There were 196 respondents in group 1, 55 in group 2, and 36 in group 3. Between groups 1 and 2 there was a statistically significant reduction in the respondents' levels of concern in every aspect of cOVH ( $p < .05$ ). Between groups 2 and 3 there was no statistically significant change in respondents' levels of concern in any aspect of cOVH ( $p \geq .21$ ). There was a significant reduction in the number of complications encountered by veterinarians in group 3 (39/102, 38.2%) compared to those in group 2 (117/206, 56.8%) ( $p = .002$ ).

Employers should anticipate high levels of concerns regarding all aspects of cOVHs in new graduates and supervision during the first 6 months may be particularly useful.

**Key words:** canine, ovariohysterectomy, complications, concerns, new graduates

# Introduction

Canine ovariohysterectomy (cOVH) is commonly performed in general practice and is the procedure that causes the most concern in 81% of final-year veterinary students in the UK.<sup>1</sup> Reported intra-operative and post-operative cOVH complications include hemorrhage, wound infection, gossypiboma, incisional hernia, ovarian remnant syndrome, uterine stump abscess formation, and ureteral injury.<sup>2-6</sup> Complications associated with cOVH have been reported in up to 52% of patients<sup>1,7,8</sup> and hemorrhage is the most common cause of cOVH-related death.<sup>9</sup>

The stress on new surgeons who lack confidence and surgical skills is potentially detrimental to the learning experience and the patient. Stress impairs judgement, decision making, and communication intra-operatively,<sup>10-12</sup> which may affect surgical duration and complication rate and may further exacerbate stress levels. There are currently no minimum requirements set by the Royal College of Veterinary Surgeons (RCVS) for surgical exposure during the undergraduate course, nor to employers undertaking the surgical supervision of new graduates. Since 2007, it has been compulsory for UK veterinary graduates to complete a Professional Development Phase (PDP) as outlined by the RCVS.<sup>13</sup> In this self-assessment learning program, cOVH is classified as a Year One competency (appearing in the “routine surgery” category). There are no minimum recommendations for the number of procedures to be conducted.

Guidance and surgical supervision of surgeons is essential for appropriate patient care in human medicine,<sup>14,15</sup> and the same may be true in veterinary medicine, although studies are required to confirm this. Therefore it is important to determine a window of time during which guidance and supervision of new graduates performing cOVH procedures might be most useful. The aims of the present study were (1) to document and compare veterinarians’

cOVH-related concerns at three time points: 1 month before graduation (group 1) and after 6 (group 2) and 12 (group 3) months of clinical first opinion practice, and (2) to document and compare the occurrence of cOVH-related complications encountered by veterinarians in groups 2 and 3.

## Materials and Methods

**Study design**—A questionnaire was designed to collect data on veterinarians' concerns and surgical complications using Bristol Online surveys. The questionnaire was sent by email to all final-year veterinary students (group 1) at five UK universities (Royal Veterinary College and the universities of Bristol, Cambridge, Nottingham, and Edinburgh) 1 month before graduation in 2010 and 2011 (<https://www.survey.bris.ac.uk/svs/group1>). Later, using the same email contact information, respondents working in clinical first opinion practice were asked to complete a similar questionnaire 6 months (group 2) and 12 months (group 3) after graduation (<https://www.survey.bris.ac.uk/svs/group2> and <https://www.survey.bris.ac.uk/svs/group3>, respectively).

The ethics committees of the participating universities approved the study. Complete confidentiality of all respondents was an ethical requirement of more than one participating institution and, therefore, it was not possible to obtain specific identities of participants and link responses at the three time points to given individuals. As a result, a repeated cross-sectional approach was used during data analysis to assess responses at each time point.

**Data collection**—Data were collected on the veterinarian's level of concern for the following aspects of a cOVH procedure: post-operative hemorrhage, leaving ovarian remnants, taking too long to complete cOVH, performing a skin incision too large/small, occurrence of post-operative infection, ligating ureters, appropriate suture material selection,

post-operative herniation, placing skin sutures too tightly, and post-operative pain. For each aspect, level of concern was graded on a scale of 1 to 5, where 1 = *not at all worried* and 5 = *extremely worried*. Data were collected on presence (yes/no) of the following surgical complications: difficulty locating/exteriorizing right or left ovary, difficulty locating/exteriorizing cervix, hemorrhage from right or left ovary, hemorrhage from cervix, hemorrhage from unknown source, skin dehiscence, ligated ureter, post-operative pain, infection, skin bruising, rectus sheath dehiscence, and pyometra.

Data were also collected on other aspects including number of cOVH procedures the graduate assisted with to date with a veterinarian also scrubbed in; number of cOVH procedures the graduate assisted with to date with no veterinarian scrubbed in; number of veterinarians employed by practice at which graduate is working; type of practice where graduate was employed (small-animal practice, mixed practice, and small-animal and equine practice); and number of cOVH procedures performed over the first 6 and 12 months of practice. In addition, graduates were asked the following: whether they received enough supervision when performing cOVH procedures; if the practice expected them to perform cOVH unsupervised immediately after qualifying (yes/no); if they received enough supervision when performing cOVH (yes/no); whether they expected scrubbed assistance to be provided only on request (yes/no); and if they expected verbal assistance to be provided only on request (yes/no).

**Statistical analysis**—Data were entered into an Excel spreadsheet and analyzed using XLSTAT statistical software (XLSTAT 2014, Addinsoft SARL, Paris, France). Medians (first and third quartile) were used to describe the grades reported for level of concern associated with each cOVH aspect. The Mann–Whitney test was used to compare median grades for level of concerns associated with each cOVH aspect between groups 1 and 2, and

between groups 2 and 3. The Chi-square test of independence was used to compare the number of complications encountered during cOVH procedures between groups 2 and 3. For each individual complication encountered during cOVH, the reported frequency was compared pairwise between groups 2 and 3 using the Wilcoxon signed-rank test. For all analyses, statistical significance was set at  $p < .05$ .

## Results

**Group 1 (1 month before graduation)**—At 1 month before graduation, 196 undergraduate veterinary students completed the questionnaire. When asked how many cOVH procedures they had assisted with to date with a veterinarian also scrubbed in, 66/196 (34%) responded more than five, 30/196 (15%) four, 36/196 (18%) three, 40/196 (20%) two, 12/196 (6%) one, and 12/196 (6%) none. When asked how many cOVH procedures they had performed to date with no veterinarian scrubbed in, 5/177 (3%) responded more than five, 5/177 (3%) four, 3/177 (2%) three, 15/177 (8%) two, 23/177 (13%) one, and 126/177 (71%) none.

Respondents graded their concerns regarding cOVH procedures (Table 1). Post-operative hemorrhage was reported as the main concern (median grade/score = 4) followed by leaving ovarian remnants behind (median = 3), taking too long to complete cOVH (median = 3), ligating ureters (median = 3), and post-operative pain (median = 3).

Respondents were asked how many cOVH procedures they thought a qualified, more experienced veterinarian should scrub in with them during their first job. Of the 196 respondents, 14 (7%) respondents thought more than five cOVH procedures; 15 (8%) thought four; 51 (26%) thought three; 56 (29%) thought two; 41 (21%) thought one; and 19 (10%) thought zero.

**Group 2 (6 months after graduation)**—Fifty-five respondents completed the questionnaire 6 months after graduation. At this time, 42% (23/55) were working in a practice employing more than seven veterinarians. Fifty-six percent (31/55) were employed in a small-animal practice, 38% (21/55) in a mixed practice, and 6% (3/55) in a small-animal and equine practice.

More than 11 cOVH procedures had been performed by 44% (24/55) of the respondents over their first 6 months of practice. Eighty-six percent (47/55) felt their practice would not expect them to be able to perform cOVH unsupervised immediately after qualifying, and 38% (21/55) had no veterinarian scrubbing in with them when they first started performing cOVH. Eighty-seven percent (48/55) felt they received enough supervision when performing cOVH, 84% (46/55) expected scrubbed assistance to be provided only on request, and 78% (43/55) expected verbal assistance to be provided only on request.

Respondents' concerns were recorded after three cOVH procedures (**Table 1**). Post-operative hemorrhage was the main concern with a median score of 2.5 followed by leaving ovarian remnants behind (median grade = 2), taking too long to complete cOVH (median = 2), and post-operative pain (median = 2). Seventy-two percent (39/55) of veterinarians assessed at 6 months after graduation did not request help from a colleague. Of those who did request help, 10/16 (63%) asked for verbal assistance and 6/16 (37%) requested scrubbed assistance.

Respondents also reported the complications they encountered during the three cOVH procedures (**Table 2**). The most frequently reported complications were difficulty locating/exteriorizing right ovary ( $n = 42$ ) and left ovary ( $n = 27$ ), followed by hemorrhage from left ovary ( $n = 9$ ), and hemorrhage from unknown source ( $n = 9$ ).

**Group 3 (12 months after graduation)**—Thirty-six respondents answered the survey 12 months after graduation. Thirty-nine percent (14/36) of the respondents were working in a practice employing more than seven veterinarians, 61% (22/36) were employed in a small-animal practice, and 39% (14/36) in a mixed practice.

More than 11 cOVH procedures had been performed by 56% (20/36) of the respondents during their first year in general practice. In the preceding 6 months, 89% (32/36) of the respondents felt they received enough supervision while performing cOVH.

Respondents' concerns were recorded after three cOVH procedures ([Table 1](#)). The main concerns were post-operative hemorrhage (median score = 2), leaving ovarian remnants behind (median = 2), taking too long to complete cOVH (median = 2), ligating ureters (median = 2), and post-operative pain (median = 2). Seventy-five percent (27/36) of veterinarians in group 3 did not request help from a colleague. Of those who did request help, 4/9 asked for verbal assistance and 5/9 requested scrubbed assistance.

Respondents also reported the complications they encountered during the three cOVH procedures ([Table 2](#)). The most frequently reported complications were difficulty locating/exteriorizing right ovary ( $n = 12$ ) and left ovary ( $n = 7$ ), followed by difficulty locating/exteriorizing cervix ( $n = 6$ ).

**Comparison of responses among groups 1, 2, and 3**—A significant reduction in levels of concern about all aspects of cOVH was observed between groups 1 and 2 ( $p < .001$  for all aspects of cOVH). No significant reduction was observed in levels of concern about any aspects of cOVH between groups 2 and 3 ( $p \geq .21$  for all aspects of cOVH). Post-operative hemorrhage was the main concern at each time point; 73% of group 1, 32% of group 2, and 28% of group 3 graded their levels of concern as 4 or 5.



In groups 2 and 3, the most commonly reported complication was difficulty exteriorizing the ovaries, with the right most commonly reported as the problematic side (Table 2). The total reported number of complications encountered during three cOVH procedures by group 3 (39/102, 38%) was considerably lower than that by group 2 (117/206, 57%) ( $p = .002$ ). For each individual complication, the reported frequency in group 3 was significantly lower than in group 2 ( $p = .01$ ).

## Discussion

The goals of the present study were to assess new graduates' concerns regarding cOVH, to report complications they faced during/after cOVH at 6 and 12 months after graduation, and to suggest a window of time during which guidance and supervision of new graduates performing cOVH procedures might be most useful.

Performing cOVH procedures is a source of stress for veterinary students and this stress may alter practical skills while performing the procedure.<sup>10</sup> Despite training received during the undergraduate course, some veterinary students are aware that they do not reach surgical proficiency solely by following the educational program.<sup>16</sup> In the present study, 32% of group 1 respondents surveyed at 1 month before graduation had assisted a qualified veterinarian with two or fewer cOVH procedures before graduation; 6% had not assisted with any cOVH. Seventy-one percent of graduating veterinarians in the present study had not performed a cOVH on their own before graduation. The failure of 6% of undergraduates to assist with a single cOVH before graduation echoes previous recommendations that veterinary schools need to develop alternatives in surgery training, and that practicing surgeons should help improve the skills of new graduates.<sup>17</sup>

At 6 months after graduation, 86% of respondents indicated that their employers did not expect them to perform cOVH unsupervised immediately after qualifying. According to a study published by Bowlt et al. in 2011,<sup>1</sup> 49% of UK practitioners believed that new graduates were not able to perform cOVH immediately after graduation; the difference between these two findings suggests that senior veterinarians within the UK are more supportive of new graduates than previously reported. In a recent study in the USA, 750 general practitioners were asked to rate proficiency levels expected in new graduates and more than 60% expected high proficiency level and minimal supervision for 21 out of 26 listed surgical skills.<sup>18</sup> These results might suggest that skill level expectations are higher for US graduates than for UK graduates, although a comparative study is required to confirm this hypothesis. It would be particularly interesting to correlate and compare this different level of expectation with stress levels among new US graduates. Encouragingly, UK graduates appear to be adequately supported by their employers: 87% of respondents at 6 months and 89% of respondents at 12 months felt they were receiving enough support.

Despite the highest initial levels of concern being recorded at 1 month before graduation, significant improvements were observed in all aspects of cOVH within the first 6 months of practice, and 44% of respondents had performed 11 or more cOVH procedures within the previous 6 months, which is greater than the four cOVH procedures previously reported to be required before new veterinarians were considered competent.<sup>1</sup> Between 6 months and 12 months after graduation, there was no significant improvement in the respondents' levels of concern for any aspect of cOVH. This suggests that support for new graduates is particularly useful within the first 6 months of practice, when the learning curve is steepest.

Of all the aspects of cOVH, post-operative hemorrhage was the greatest concern for new veterinarians, and remained a concern until 12 months after graduation. After 6 and 12 months, 32% and 28% of respondents, respectively, graded their level of concern regarding hemorrhage as 4 or 5. However, hemorrhage was not the most common complication and was only reported in 32/117 (27%) and 7/39 (17.9%) of cOVH procedures at 6 and 12 months, respectively. This is comparable with other studies in which hemorrhage was reported in up to 26.3% of cases.<sup>1,11</sup> A more detailed study would be required to quantify the hemorrhage encountered. However, findings in the present study support previous reports that hemorrhage is a major concern for inexperienced veterinarians.<sup>2,19</sup> Even when undergraduates are taught how to identify ovarian and cervical stumps for hemorrhage, high levels of concerns remain and students readily forget about other options available to control mild/moderate hemorrhage (e.g., abdominal wraps, blood transfusions).<sup>1,9</sup> Employers should be available to provide reassurance and assistance particularly in this area, even 12 months after graduation. This may help avoid inappropriate and unnecessary second surgeries, as well as decrease employee stress.

In the present study, as in Burrow et al.,<sup>11</sup> the most common complication encountered while performing cOVH was difficulty exteriorizing the ovaries. The number of complications reduced significantly between 6 and 12 months after graduation, but difficulty with exteriorization of the right ovary remained the most common individual complication at both times. This finding may be explained by the more cranial abdominal location of the right ovary; therefore, provision of guidance from senior veterinarians regarding ovarian exteriorization (e.g., how to break the suspensory ligament) and appropriate incision length might be beneficial at an early stage and even after 12 months of clinical practice.

The significant decrease in complications reported between 6 and 12 months of clinical practice contradicts a previous study, which reported a comparable incidence of cOVH post-operative complications when surgery was performed by a trained veterinarian or a final-year student.<sup>8</sup> This may be because the final-year students in the latter study were under direct supervision, whereas the qualified new veterinarians in the present study were not. Thirty-eight percent of respondents at 6 months after graduation did not have a more experienced veterinarian scrubbed in with them when they began performing cOVHs. These unsupervised procedures may lead to an increased complication rate at the beginning of an unsupervised learning curve. Furthermore, a high number of respondents (71%) at 1 month before graduation had not performed any cOVH procedures without a veterinarian present, and 72% of respondents did not request any assistance from a colleague at 6 months after graduation. Employers should encourage new veterinarians to ask for assistance at an early stage, as required.

The present study had several limitations. First, due to a requirement for complete respondent confidentiality imposed by participating institutions, it was not possible to obtain specific identities of participants and to link responses at the three time points (1 month before graduation, 6 and 12 months after graduation). Doing so would allow analysis of progression of responses over the three time points. Instead, a repeated cross-sectional approach was used to analyze the data in the present study. Confidentiality requirements also prevented comparisons between institutions and therefore between training programs. Second, the questionnaire response rate was low. For the first group of respondents, this may be because the questionnaires were sent 1 month before graduation, at a time when respondents would have been revising for examinations. Earlier enrolment was not desirable because responses may not have been accurate if some extramural studies had yet to be

completed before graduation, further improving experience. A low response rate at 6 and 12 months may be explained by the requirement for prospective assessment of three cOVH procedures, which may have been time-consuming, or may not have been possible for individuals with a lower case load (of cOVH). Therefore, there may be response bias toward motivated veterinarians with a larger case load, or away from less confident veterinarians who may be embarrassed to admit any difficulties encountered. A definition of “supervision” should also have been provided to respondents. Finally, pyometra following an ovariohysterectomy is usually a late onset occurrence and the follow-up time may not be long enough to accurately comment on this particular post-operative complication, therefore this should not have been included in the questionnaire.

In conclusion, undergraduates reported high levels of concern about cOVH, but this reduced significantly during the first 6 months of clinical practice. Post-operative hemorrhage remained the main cause for concern for new veterinarians throughout the first 12 months of practice, but hemorrhage was not the most frequently encountered complication. Exteriorization of the right ovary was the most commonly reported complication at the first 6 and 12 months of clinical practice. Although a high percentage of new graduates indicated that clinical support was available when needed, employers should be aware of new graduates’ concerns and should play a supportive role, particularly during the first 6 months of clinical practice.

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## Author Information

**Kelly L. Bowlt Blacklock**, Animal Health Trust, Lanwades Park, Kentford, Newmarket, Suffolk CB8 7UU, UK. Email: [kelly.bowlt@aht.org.uk](mailto:kelly.bowlt@aht.org.uk).

**Pierre Langer**, Animal Health Trust, Lanwades Park, Kentford, Newmarket, Suffolk CB8 7UU, UK.

**Zoe Halfacree**, Clinical Science and Services, The Royal Veterinary College, Hawkshead Lane, North Mymms, Hatfield, Hertfordshire AL9 7TA, UK.

**Donald A. Yool**, Hospital for Small Animals, Royal (Dick) School of Veterinary Studies, University of Edinburgh, Easter Bush Veterinary Centre, Roslin, Midlothian EH25 9RG, UK.

**Sandra Corr**, Small Animal Surgery, Faculty of Medicine & Health Sciences, Room C11 Gateway, Sutton Bonington Campus, Sutton Bonington, Leicestershire LE12 5RD, UK.

**Laura Owen**, The Queen's Veterinary School Hospital, Department of Veterinary Medicine, University of Cambridge, Madingley Road, Cambridge CB3 0ES, UK.

**Ed Friend**, University of Bristol, Langford House, Langford, Bristol BS40 5DU, UK

**Abel Ekiri**, Animal Health Trust, Lanwades Park, Kentford, Newmarket, Suffolk CB8 7UU, UK.

**Table 1:** Levels of concern in newly qualified veterinary surgeons performing cOVH procedures at 1 month before graduation, and at 6 and 12 months after graduation

Area of concern	Median (first and third quartile) grades for level of concern		
	1 month before graduation (n = 196)	6 months after graduation (n = 55)	12 months after graduation (n = 36)
Post-operative hemorrhage	4 (3, 4.25)	2.5 (2, 4)	2 (2, 4)
Leaving ovarian remnants behind	3 (2, 4)	2 (1, 3)	2 (1, 2)
Taking too long to complete cOVH	3 (2, 4)	2 (1, 3)	2 (1, 3)
Skin incision too large/small	2 (1, 2)	1 (1, 2)	1 (1, 2)
Post-operative infection	2 (2, 3)	1 (1, 2)	1 (1, 2)
Ligating ureters	3 (2, 3)	1 (1, 2)	2 (1, 2)



Appropriate suture material selection	2 (2, 3)	1 (1, 2)	1 (1, 2)
Post-operative herniation	2 (2, 3)	1 (1, 2)	1 (1, 2)
Placing skin sutures too tightly	2 (2, 3)	1 (1, 2)	1 (1, 2)
Post-operative pain	3 (2, 4)	2 (1, 3)	2 (1, 2)

Levels of concern were graded on a scale of 1 to 5, where 1 = *not at all worried* and 5 = *extremely worried*.

**Table 2:** Reported complications encountered during three cOVH procedures performed during the first 6 and 12 months of practice

Type of complication	Number of respondents	
	6 months	12 months
Difficulty locating/exteriorizing right ovary	42	12
Difficulty locating/exteriorizing left ovary	27	7
Difficulty locating/exteriorizing cervix	2	6
Hemorrhage from right ovary	8	2
Hemorrhage from left ovary	9	1
Hemorrhage from cervix	6	0
Hemorrhage (unknown source)	9	4
Skin dehiscence	4	0
Ligated ureter	0	0
Painful post-op	2	1
Infection	0	0
Skin bruising	2	2
Rectus sheath dehiscence	0	0
Pyometra	4	2
Other	2	2
None	89	63