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A survey of current practices and influences on the choice of suture material, pattern and size used in commonly performed procedures in UK small animal veterinary practice

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ABSTRACT

Objectives A survey of UK veterinarians was conducted to determine factors influencing suture choice and current suture practice for common surgical procedures.

Methods An online survey was designed and the survey was sent to central practice emails obtained from the 2011 Royal College of Veterinary Surgeons (RCVS) practice database.

Results Two hundred and thirty-nine surveys were completed (203 with no additional postgraduate qualifications (NAQ), 16 with RCVS certificates and 19 with diplomas). Forty-seven per cent of veterinary surgeons reported they would benefit from Continued Professional Development (CPD) pertaining to suture material selection and techniques. The NAQ group ranked practice policy, colleague influence, cost of suture material and undergraduate teaching significantly greater than diploma and certificate holders. The widest differences between suture material selection, pattern and size were identified when comparing diploma holders and the NAQ group. Diploma holders tended to choose smaller sized suture material when compared with the NAQ group.

Clinical significance In conclusion, postgraduate qualifications have a significant effect on the choice, pattern and size of suture material used for many routine surgical procedures. Findings suggest that further postgraduate training pertaining to the selection and use of suture material is worthwhile and improved guidance of choice of suture material for commonly performed surgical procedures may be beneficial.

INTRODUCTION

Appropriate selection and application of suture material for surgical procedures is an important factor in determining the success or failure of surgery. Selected suture material and its application should provide safe and secure wound closure that is maintained for the duration of wound healing with minimal morbidity (Boothe 1998).

Decisions regarding suture selection and use are typically based on several factors including physical and biological characteristics of the suture material, the tissue being sutured, clinical experience, practice policy, undergraduate and/or postgraduate training. A wide choice of suture materials is available to veterinary surgeons and often more than one suture material may be appropriate for a given procedure. As a consequence, the surgeon must choose a suture that most closely approximates the ideal for a given procedure and the tissue to be sutured (Fossum 2013).

A wealth of research exists in both the human and veterinary literature comparing specific suture material properties and suture patterns used for individual procedures (Radasch and others 1990, Kirpensteijn and others 2001, Mimae and others 2010). However, to the authors' knowledge only one previous study published over 20 years ago (Bellenger and Meek 1990) reported suture material selection and practice by veterinary surgeons in the clinical environment. In this study, it was identified that surgical catgut was the most popular choice for several routine procedures including for enterotomy closure. Since that time, newer suture materials have become available and are routinely used (Kirpensteijn and others 2001).

The aim of this study was to (1) survey small animal veterinary surgeons in the UK to document the decision-making process in and selection of suture material, pattern and size chosen for a range of commonly performed surgical procedures, and (2) to determine if suture practice is influenced by postgraduate training. Our hypothesis was that a wide variation in the type and size of suture materials selected for common surgical procedures would exist and the level of postgraduate qualification would significantly affect the choice and application of suture.

MATERIALS AND METHODS

An online survey was designed to obtain information pertaining to factors influencing clinical practice, decision making, choice of suture material and use by UK small animal veterinary surgeons. The survey was made publicly available online using the University of Bristol Online Survey programme (https://www.survey.bris.ac.uk/awb/suture_survey) between February and July 2012. Practices were selected using the 2011 Royal College of Veterinary Surgeons (RCVS) practice database. All those listed as performing 'small animal', 'mixed' or those whose practice type was not recorded were selected. The central email was selected for practices with multiple branches.

A letter (Hebert 2012) was also sent to the editor of the *Veterinary Record* journal asking readers to complete the online survey. Participants were asked to complete the survey (available as an online supplementary file) and provide information pertaining to undergraduate training, postgraduate training and details of their current employment.

Participants were asked to assign a number on a scale of 1–10 to the degree of influence of various factors on their suture choice (1=does not influence choice, 10=major influence on choice). The survey asked which suture material, pattern and size of material, from a list of 35 types, they would use for a range of routine surgical procedures in a 25 kg dog. If they did not use a material, pattern or size from the list provided, they were asked to give details of what they did use.

STATISTICAL ANALYSIS

Answers from the questionnaire were entered into a spreadsheet (Excel V.2007, Microsoft, USA) and statistical analysis performed (PASW Statistics V.21.0; IBM, Somers, New York, USA). Any questions not answered were recorded as missing and the statistical analysis and proportions were expressed as percentages of the number of responses obtained; that is, not including those that were missing in the denominator. The degree of influence, scored from 1 to 10, was treated as continuous data and normality was assessed visually and using one-sample Kolmogorov- Smirnov tests. Suture materials, pattern and size were categorised into groups. The 35 types of suture materials from the list provided in the questionnaire were categorised into the following 10 groups: chromic catgut, short-acting monofilament, short-acting multifilament, medium-acting monofilament, medium-acting multifilament, long-acting monofilament, long-acting multifilament, non-absorbable monofilament, non-absorbable multifilament and other. Descriptive analysis was performed for each variable. Data from respondents were categorised into three groups: Royal College of Veterinary Surgeons (RCVS) certificate holders, European College of Veterinary Surgeons (ECVS)/American College of Veterinary Surgeons (ACVS)/RCVS diploma holders and those with no additional qualifications (NAQ).

Association between postgraduate qualification and recorded variables was assessed using one-way Kruskal-Wallis analysis of variance with post hoc Mann-Whitney U pairwise tests. Categorical variables were compared between groups using chi-squared test where appropriate. Statistical significance was set as $p<0.05$.

RESULTS

A total of 1929 practices were registered as primarily treating small animals, 1906 had email addresses. Once duplicate email addresses were removed from those practices with multiple branches, there were 1554 remaining. Of the 1554 emails sent out, 48 were undeliverable, a total of 1506 emails were therefore delivered. Two hundred and thirty-nine veterinary surgeons completed the survey, giving a response rate of 15.9 per cent.

Demographic data

The responses received showed that there was a fairly even split between veterinary schools that participants have graduated from. However, the majority (65 per cent) of participants were over 10 years qualified (Table 1). The postgraduate qualifications held by participants and the RCVS practice standards Tier are shown in Table 1.

Undergraduate and postgraduate training

When considering undergraduate training 14 (6 per cent) suggested increased practical training in preclinical years was needed, while 94 (39 per cent) thought an increase during clinical years was needed and 26 (10.9 per cent) suggested increased training in preclinical and clinical years was needed. Thirty-six (15.1 per cent) thought teaching was adequate, 40 (16.7 per cent) thought that other methods were necessary to improve undergraduate training (29 participants did not answer the question (12.1 per cent)). One hundred and eight veterinary surgeons (47 per cent) reported they would benefit from Continued Professional Developement (CPD) in suture material selection and techniques and 120 (53 per cent) felt they would not.

Importance of factors influencing choice of suture material

This showed that diploma holders ranked practice policy, what they were taught as a student, colleague influence and cost much lower than the NAQ group. Comparatively they ranked suture properties higher than the NAQ group (Table 2).

Suture material, pattern and size for individual procedures

The most common suture material used for skin was non-absorbable multifilament. Short-acting monofilament was most commonly chosen for subcutaneous closure. Long-acting monofilament was most commonly chosen for linea alba, gastrotomy, enterotomy, enterectomy and cystotomy closure. Chromic catgut was most commonly used for ovarian pedicle and cervical stump ligation. Multifilament medium-acting suture material

TABLE 1: Demographic data from survey questions asked to participants

Survey question	Number of participants (%)
1. Where qualified	
Cambridge	18 (7.5)
Liverpool	24 (10)
RVC	57 (23.8)
Bristol	52 (21.8)
Edinburgh	28 (11.7)
Glasgow	24 (10)
Dublin	3 (1.3)
Other	33 (13.8)
2. Qualification (years)	
2	8 (3.3)
3–5	34 (14.2)
6–10	43 (18)
11–20	85 (35.6)
20+	69 (28.9)
3. Postgraduate qualifications	
RCVS Certificate (old style or CertAVP)	17 (7.1)
ECVS/ACVS/RCVS Diploma	19 (7.9)
None of the above	186 (77.8)
Other non-surgical certificate	13 (5.4)
Other (eg, PhD)	4 (1.7)
8. RCVS practice accreditation*	
Tier 1	6 (2.5)
Tier 2	113 (47.3)
Tier 3	57 (23.8)
Unknown	17 (7.1)
Not employed/locum	2 (0.8)
Not accredited	44 (18.4)

*RCVS practice standards scheme: Tier 1 = core standards, Tier 2 = general practice, Tier 3 = veterinary hospital (see rcvs.org.uk for full details).
ECVS, European College of Veterinary Surgeons; ACVS, American College of Veterinary Surgeons; CertAVP, Certificate in Advanced Veterinary Practice; RCVS, Royal College of Veterinary Surgeons; RVC, Royal Veterinary College.

was most commonly chosen for femoral artery ligation (Table 3).

A simple continuous pattern was the most commonly used for subcutaneous and linea alba closure overall. A simple interrupted suture was most commonly used for enterotomy closure. However, for closure of gastrotomy and cystotomy the majority in the NAQ group closed with a continuous inverting pattern, compared with the majority of the other two groups closing with a simple continuous pattern (Table 4).

Three-metric suture was most commonly used for linea alba closure, ovarian pedicle ligation, cervical stump and femoral artery ligation. Two-metric suture material was most commonly chosen for skin, gastrotomy, enterotomy, enterectomy and cystotomy closure (Table 5).

Significant differences between groups are reported in Table 6.

DISCUSSION

This study confirmed our hypothesis that there is a wide variation in the type and size of suture material used by UK veterinary surgeons for routine surgical procedures. In addition, postgraduate qualification was a significant influence on the choice of suture material and pattern used. Postgraduate qualifications were also influential in determining veterinary surgeons' individual priorities when considering which factors were important when making these decisions regarding suture choice.

Demographic data

Twenty-six (15 per cent) veterinary surgeons surveyed held a postgraduate qualification (RCVS certificate or surgical diploma). In 2012, the RCVS reported that 281 (0.01 per cent) veterinary surgeons had been awarded an RCVS certificate in small animal surgery and 48 (0.002 per cent) held an RCVS diploma in small animal surgery. Our population of respondents included higher percentage of veterinary surgeons with postgraduate qualifications. Only two-and-a-half per cent of veterinary surgeons worked in Tier 1 RCVS-accredited practices, with the majority in Tier 2 (47.3 per cent) or Tier 3 (23.8 per cent). Our results show a larger proportion of veterinary surgeons working in RCVS-accredited practices than the 2012 published data with 26.4 per cent in non-RCVS-accredited practices compared with the 51 per cent published. The difference between the RCVS published data and our population may have skewed our results. The difference may reflect the individuals more inclined to respond to the survey, that is, those in more advanced practices or those who are more familiar with the veterinary literature.

Undergraduate and postgraduate training

The majority of respondents (85 per cent) felt that the training veterinary students received in their undergraduate training regarding suture selection practice was inadequate. This raises potential concern over the content of current undergraduate programmes. Inadequate training may explain the stark differences between choices made by different postgraduate qualification groups, with suture practice predominantly learned postgraduation. Nearly half of veterinary surgeons surveyed felt they would benefit from CPD on suture materials, selection and techniques. Suture practice is fundamental to the success of surgery and this finding suggests continuing professional development courses could include this subject in the future.

TABLE 2: Median, minimum and maximum values for degree of influence of factors on the choice of suture material. Participants were asked to assign a number on a scale of 1–10 to the degree of influence of various factors on their suture choice (1 = does not influence choice, 10 = major influence on choice)

	RCVS certificate		Diploma		None	
Factor	**Median**	**Range**	**Median**	**Range**	**Median**	**Range**
9. Taught as student	5*	1–8	3†	1–10	7*†	1–10
10. Practice policy	5‡	1–10	1*‡	1–10	7†	1–10
11. Colleague influence	5	1–10	3†	1–10	6†	1–10
12. Postgraduate training	9*	1–10	9†	1–10	8 *†	1–10
13. Own clinical experience	9	4–10	8	1–10	9	1–10
14. Financial cost	3*	1–10	2*‡	1–6	5†	1–10
15. Initial strength of suture	9	5–10	9	1–10	8	1–10
16. Initial material properties	9†	6–10	10†	5–10	8*†	1–10
17. Handling properties	8	5–10	8	3–10	8	1–10
18. Rate of absorption	8	5–10	9	1–10	8	1–10
19. Rate of loss of strength	9	5–10	9†	1–10	8†	1–10
20. Type of needle	8	1–10	8†	2–10	8†	1–10
21.Swage on needle	9	1–10	10†	5–10	8*‡	1–10
22. Colour	1	1–4	1	1–8	1	1–8

*None v certificate.
†Diploma v none.
‡Certificate v diploma.
RCVS, Royal College of Veterinary Surgeons.
Factor numbers related to question number in survey (see supplementary file).

Ranked importance of factors influencing choice of suture material

Factors influencing suture material selection differed significantly between the groups holding different postgraduate qualifications. Findings suggest that veterinary surgeons without postgraduate qualifications are less influenced by the material properties of the suture material and are more influenced by practice policy and the influence of colleagues. The presence of a swaged needle was considered to be very important in the diploma group but less so in the NAQ group. This may in part be explained by the fact that there is still widespread use of cassettes in general practice and as a consequence veterinary surgeons would be forced to use a non-swaged needle. The absence of a swage on needle and using suture from a reel significantly decreases cost but increases tissue drag and resultant trauma and once opened the absolute sterility of the reel cannot be ensured.

Suture material, pattern and size for individual procedures

A wide range of suture materials, patterns and sizes were used for the procedures included in the survey, clearly demonstrating the variable opinions of veterinary surgeons. This demonstrates that for most commonly performed surgical procedures there may be more than one suitable material pattern or size. Interestingly, the widest differences between suture material selection, pattern and size were identified when comparing the diploma holders and the NAQ group. Ninety-five per cent of diploma and certificate holders indicated that they would close the linea alba with a long-acting absorbable material and 100 and 88 per cent of diploma holders and certificate holders, respectively, used a simple continuous pattern. This compared with 51 per cent of the NAQ group using a long-acting absorbable material in a simple continuous pattern. A simple continuous pattern has been shown to be an acceptable method for closure of the linea alba (Rosin 1985). It can be performed more rapidly than a simple interrupted pattern and has the benefit of two knots rather than several. This is considered important as the knot has been demonstrated to be the weakest part of the suture loop (Richey and Roe 2005). The knot is where the most significant tissue reaction occurs and subsequently reducing the amount of foreign material within the surgical site will reduce the resulting inflammation (Rosin and Robinson 1989, Marturello and others 2013). Newer graduates may be more inclined to use a simple interrupted pattern while their surgical experience develops. However, our cohort was predominantly veterinary surgeons over 10 years qualified (65 per cent).

The suture used for ovarian pedicle ligation varied significantly between groups; chromic catgut was the most commonly chosen by the NAQ group compared with medium-acting monofilament being the most common used by diploma holders. In a previous study investigating canine neutering techniques, 86 per cent

TABLE 3: Suture material used. Participants were asked which suture material they used for routine surgical procedures in a 25 kg dog

	Catgut			Short-acting monofilament			Short-acting multifilament			Medium-acting monofilament			Medium-acting multifilament			Long-acting monofilament			Non-absorbable monofilament			Non-absorbable multifilament			Other		
Factor	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**
Skin closure		7.7	1.9	5.3	35.7	21.9	5.3		1.3			3.1	5.3		12.5			3.1	57.9	42.9	8.1		14.3	46.9	26.4		1.2
Subcutaneous closure		7.7	29.6	78.9	76.9	27.4			0.7	5.3		4.4	5.3		23.7	10.5	15.4	14.1									
Linea alba closure			2.0			2.0				5.3	5.9	3.4			37.9	94.7	94.1	51.7			0.5			1.5			1
Ovarian pedicle ligation	5.3	23.5	56.7		5.9	1.5						1.5	63.2	52.9	32.8	21.1	17.6	7.5							10.5		
Cervical stump ligation	10.5	40.0	67.3			3.4				10		2	10	10.0	12.2	60	50	15							10		
Gastrotomy closure			1.5	26.3	25.0	23.6			0.5	10.5	18.8	14.8		25	20.7	63.2	31.3	38.9									
Dog enterotomy closure			0.5	21.1	35.3	27.6				10.5	11.8	14.3		23.5	18.2	68.4	29.4	39.4									
Enterectomy closure			0.5	21.1	29.4	24.6				10.5	11.8	12.8		17.6	20.2	68.4	41.2	41.4						0.5			
Cystotomy closure			2.5	42.1	35.3	29.1				10.5	17.6	12.3		17.6	22.7	47.4	29.4	33.5									
Femoral artery ligation		11.8	42.9	15.8		3					5.9	3	47.4	64.7	39.9	26.3	17.6	10.3	10.5		1						

Numbers are displayed as a percentage of the responses within the qualification group.
Cert, certificate; Dip, diploma; NAQ, no additional qualifications.

TABLE 4(A): Suture pattern used. Participants were asked what suture pattern they used for routine surgical procedures in a 25 kg dog

	Simple interrupted (%)			Simple continuous (%)			Cruciate/ mattress (%)			Gambee (%)			Ford interlocking (%)			Other (%)			Horizontal mattress (%)			Continuous inverting (%)			Continuous everting (%)			Intradermal (%)		
Factor	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**
Skin closure	21		11.3	5.3	11.8	1.5	21.1	35.3	28.1				21.1	5.9	0.5	15.8		0.5		5.9	4.4							15.8	41.2	53.2
Subcutaneous closure			2.5	89.5	82.4	88.7			0.5									1	5.3		1							5.3	17.6	6.4
Linea alba closure		11.8	37.4	100	88.2	51.2			6.4			0.5			3						1.5									
Gastrotomy closure	10.5	5.9	19.3	57.9	58.8	29.6										10.5						21.1	35.3	49		1				
Enterotomy closure	68.4	35.3	57.1	26.3	47.1	23.2			0.5		11.8	1						1				5.3	5.9	15.8		1.5				
Enterectomy closure	68.4	47.1	71.9	31.6	41.2	17.2						1.5						2						6.4		1				
Cystotomy closure	10.5	11.8	18.2	68.4	47.1	31.5					5.9	0.5				5.3		2			0.5	15.8	35.3	46.3		1				

TABLE 4(B): Ligature patterns used. Participants were asked what ligature pattern they used for routine surgical procedures in a 25 kg dog

	Simple interrupted (%)			Square knot (%)			Surgeon's knot (%)			Transfixing (%)			Sliding square knot (%)			Miller's knot (%)			Other (%)		
Factor	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**
Ovarian pedicle ligation	15.8	5.9	9.4	10.5	23.5	10.3	5.3	29.4	56.2	15.8	17.6	19.2	31.6	23.5	3	10.5		1.5	10.5		0.5
Femoral artery ligation	10.5	11.8	11.9	36.9	35.3	14.9	5.3	17.6	62.1	26.3	23.5	5.5	10.5	11.8	2			0.5	10.5		2
Cervical stump ligation	5.3	5.9	8.4	11.2	5.9	3.4		5.9	22.2	55.6	64.7	60.1		11.8	1			1.5	27.8	5.9	3.5

Numbers are displayed as a percentage of the responses within the qualification group.
Cert, certificate; Dip, diploma; NAQ, no additional qualifications.

TABLE 5: Suture size used. Participants were asked what suture size they used for routine surgical procedures in a 25 kg dog.

	0.5 metric (%)			1.5 metric (%)			2 metric (%)			3 metric (%)			3.5 metric (%)			4 metric (%)			4.5 metric (%)			Other (%)		
Factor	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**	**Dip**	**Cert**	**NAQ**
Skin closure	5.3		0.5	5.3		6.4	68.4	41.2	41.9		52.9	42.9	5.3		5.4		5.9	1.5				15.8		1
Subcutaneous closure				10.5	11.8	4.4	52.6	35.3	45.3	31.6	41.2	41.4	5.3	5.9	5.9		5.9	2.5						0.5
Linea alba closure						0.5			4.4	5.3	41.2	52.2	84.2	47.1	31.5	10.3	11.8	10.3			0.5			0.5
Ovarian pedicle ligation			2			0.5	26.3	5.9	3	42.1	47.1	31.5	15.8	23.5	22.2		5.9	21.7	5.3	17.6	15.8	10.5		3.5
Gastrotomy closure				10.5	5.9	7.9	63.2	58.8	59.6	26.3	35.3	29.1			2.5			0.5						0.5
Enterotomy closure			1	57.9	29.4	24.1	36.8	52.9	61.6	5.3	17.6	12.3			0.5									0.5
Enterectomy closure	10.5			57.9	23.5	25.6	36.8	64.7	61.6	5.3	11.8	11.3			1									0.5
Cystotomy closure			0.5	52.6	17.6	19.2	42.1	52.9	62.6	5.3	29.4	16.7			0.5									0.5
Cervical stump ligation			1.5			0.5	27.8	5.9	3.4	50	41.2	35	11.1	29.4	22.2		5.9	19.7	5.6	17.6	15.3	5.6		2.5
Femoral artery ligation			0.5			2.5	63.2	17.6	31.2	36.8	76.5	43.6			8.9		5.9	8.4			4			1

Numbers are displayed as a percentage of the responses within the qualification group.
Cert, certificate; Dip, diploma; NAQ, no additional qualifications.

TABLE 6: This table shows the significant differences between qualification groups

Factor	Certificate v diploma	Certificate v none	Diploma v none	P value
Linea alba: material	0.4	0.39	0.81	0.57
Linea alba: pattern	0.2	0.14	0.002*	0.03*
Linea alba: size	0.02*	0.63	<0.001*	0.09
Ovary: material	0.3	0.06	<0.001*	<0.001*
Ovary: pattern	0.21	0.02*	<0.001*	<0.001*
Ovary: size	0.25	0.66	0.001*	0.008*
Gastrotomy: material	0.07	0.82	0.12	0.89
Gastrotomy: pattern	0.57	0.25	0.01*	0.02*
Gastrotomy: size	0.89	0.96	0.97	0.99
Enterotomy: material	0.06	0.89	0.13	0.62
Enterotomy: pattern	0.13	0.09	0.77	0.23
Enterotomy: size	0.20	0.83	0.07	0.36
Enterectomy: material	0.13	0.97	0.15	0.81
Enterectomy: pattern	0.19	0.04	0.68	0.17
Enterectomy: size	0.13	0.99	0.09	0.37
Cystotomy: material	0.19	0.92	0.17	0.87
Cystotomy: pattern	0.38	0.39	0.04*	0.26
Cystotomy: size	0.05	0.59	0.04*	0.34
Femoral artery: material	0.35	0.09	<0.001*	<0.001*
Femoral artery: pattern	0.78	0.002*	<0.001*	<0.001*
Femoral artery: size	0.01*	0.47	0.31	0.37

*Significant results.

of university teachers did not recommend the use of chromic catgut for ovarian or cervical ligatures but 76 per cent of veterinary practitioners teaching new graduates did (Tivers and others 2005). As a consequence of chromic catgut being a natural substance, it is known to have variable absorption rates depending on the local conditions and is not uniform in dia

meter and subsequently strength (Howes 1928). There are several suture materials available with improved and more predictable properties. The use of catgut is not recommended in human and veterinary surgery (Bellenger and Meek 1990). Previous studies have documented the widespread use of chromic catgut in veterinary practitioners for routine procedures despite the lack of evidence for its use (Bellenger and Meek 1990, Tivers and others 2005). Our study confirms this is still common practice.

When considering suture material size, diploma holders tended to choose smaller sized suture material when compared with the NAQ group. The smallest diameter suture should be used in surgery that has a strength equivalent or greater than the tissue being sutured. Larger suture diameter results in increased trauma when passed through tissue and results in a larger amount of foreign material in the surgical site.

Fifty-six per cent of the NAQ group would apply a surgeon's knot for ovarian pedicle ligation, compared with the majority of diploma holders choosing either a sliding square knot, transfixing or miller's knot. The surgeon's knot is not recommended for vessel ligation, the second throw prevents the knot from being easily tightened and it can withstand only a slight strain on the suture loop (Fossum 2013). It seems unlikely that undergraduates were taught to use larger suture size and a surgeon's knot but more likely, veterinary surgeons have chosen to use this due to external influences beyond their undergraduate training. This also seems likely with the continued widespread use of chromic catgut.

For visceral closure, appositional patterns have been advocated over inverting patterns as they do not result in a reduction in lumen size and provide anatomic alignment of tissue layers (Radasch and others 1990). Despite this, 49 per cent of the NAQ group chose an inverting suture pattern for gastrotomy closure compared with 58 per cent of diploma holders using a simple continuous pattern.

By nature of design, there are a number of limitations to this study. There was a higher number of diploma and certificate holders in our data set than reported to be active by the RCVS database. There was a low percentage of new graduate responders. Veterinary surgeons from all main UK universities were represented; however, the majority were over 11 years qualified (65 per cent), and of those, 29 per cent were over 20 years qualified. This

may be a reflection of the study design where the survey was sent to the practice email. It is probable that more experienced veterinary surgeons take the responsibility of responding to practice emails.

In conclusion, the level of postgraduate qualifications results in a significant effect on the selected suture material, suture pattern and suture size for many commonly performed routine surgical procedures in a 25 kg dog. General practitioners with no additional surgical qualifications rated suture cost, undergraduate training and colleague influence as a significantly higher influence on suture choice than diploma holders. Findings suggest that further postgraduate training pertaining to the selection and use of suture material would be worthwhile and improved guidance of choice of suture material for commonly performed surgical procedures may be beneficial.

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