
Cross-sectional survey of surgical techniques used to perform dog and cat spays in New Zealand veterinary practice

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Supplementary Table 1. Questions used in a survey of veterinarians in New Zealand about their surgical techniques used to perform dog and cat spays.

How Many Ways to Spay? Survey



Participation in this survey is voluntary and by completing this questionnaire you give consent to this data being stored and analysed. Results from the study will always be presented in a manner that prevents identification of individual veterinarians or practices.

Instructions

This survey contains 6 sections that will ask about: (1) your background; (2) feline spay surgery procedures; (3) canine spay surgery procedures; (4) experiences supervising BVSc students with performing desexing procedures; (5) experiences supervising new graduates with desexing procedures; and (6) any additional comments. The survey will remain open from **01 April 2018** through **30 May 2018** and may be completed ONE of following three ways:

(1) Online survey version:

<https://www.surveymzmo.com/s3/4236099/SpaySurvey>

(2) Scanned and e-mailed to:

c.gates@massey.ac.nz

Subject: National Spay Survey

(3) Returned by post to:

Dr. Carolyn Gates

Massey University

School of Veterinary Science

Private Bag 11-222

Palmerston North 4442

Section 1: Background Information

1.1 Name: _____ (optional)

1.2 Practice Name: _____ (optional)

1.3 Veterinary School Attended:

Name of School: _____ Country: _____

Year of Graduation: _____

1.4 Practice Type: ☐ Small Animal Exclusive ☐ Large Animal Exclusive ☐ Mixed Small and Large Animal
☐ Other (please specify: _____)

1.5 Approximately how many dog and cat desexing surgeries did you perform under supervision BEFORE graduation (Note: it is okay to round these estimates if you cannot remember specific numbers)?

Dog Neuter _____ Dog Spay _____ Cat Neuter _____ Cat Spay _____

1.6 On a scale of 1 (least confident) to 10 (most confident), how confident did you feel performing dog and cat desexing surgeries AT THE TIME OF graduation?

Dog Neuter _____ Dog Spay _____ Cat Neuter _____ Cat Spay _____

1.7 Approximately how many dog and cat desexing surgeries did it take AFTER graduation before you felt completely confident performing the procedure?

Dog Neuter _____ Dog Spay _____ Cat Neuter _____ Cat Spay _____

1.8 How would you rate the level of support you received from your first employer after graduation to become competent at desexing procedures?

☐ Very Poor ☐ Poor ☐ Adequate ☐ Good ☐ Very Good

1.9 Approximately how many dog and cat desexing surgeries do you perform on average every month in your current practice as primary surgeon?

Dog Neuter _____ Dog Spay _____ Cat Neuter _____ Cat Spay _____

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Section 2: Feline Spay Surgery Procedures

Please answer the following questions as they relate to how you would perform a routine spay for a healthy 5kg young adult female domestic shorthair cat with a BCS of 3/5 that is not currently pregnant, lactating, or in-heat, and has no other known medical problems. For each question, you may select all options that apply, but please try to select only the ones that would apply to this specific patient.

2.1 Pre-Operative Protocols

Patient Assessment	☐ Physical exam ☐ Pre-anaesthetic bloodwork (PCV/TP only) ☐ Pre-anaesthetic bloodwork (Full biochemistry panel)
Admission Time	☐ Morning of procedure ☐ Night before procedure
Surgeon Attire	☐ Surgical cap ☐ Surgical gown ☐ Face mask ☐ Gloves
Surgical Scrub	☐ No scrub ☐ Chlorohexidine scrub ☐ Iodine scrub ☐ Alcohol-based hand rub
Gloving Method	☐ Open gloving ☐ Closed gloving ☐ NA

2.2 Induction and Anaesthesia

IV Catheterization	☐ None ☐ IV Catheter		
Pre-med and/or Induction Drugs	Name	Dose (mg/kg)	Route
Drug 1			☐ IM ☐ IV ☐ SQ
Drug 2			☐ IM ☐ IV ☐ SQ
Drug 3			☐ IM ☐ IV ☐ SQ
Drug 4			☐ IM ☐ IV ☐ SQ
Airway Maintenance	☐ Intubation (w/ Lidocaine splash block) ☐ Intubation (w/out Lidocaine splash block) ☐ Face Mask ☐ None		
Breathing Circuit	☐ None ☐ Re-breathing circuit ☐ Non re-breathing circuit		
Heat Support	☐ None ☐ Bair Hugger ☐ Heated Table ☐ Heating Pad ☐ Other (please specify: _____)		
Patient Monitoring	☐ None ☐ Pulse Oximeter ☐ CO ₂ Monitor (capnograph) ☐ EKG ☐ apAlert ☐ Oesophageal Stethoscope ☐ Regular Stethoscope ☐ Blood Pressure ☐ Other (please specify: _____)		
Fluids	☐ No fluids ☐ IV Fluids ☐ SQ Fluids		
Maintenance Anaesthesia	☐ None ☐ Isoflurane 2% ☐ Isoflurane 1.5% ☐ Isoflurane 1.0% ☐ Isoflurane 0.5% ☐ IV Maintenance ☐ Other (please specify: _____)		
Surgical Site Preparation	☐ Chlorohexidine ☐ Methylated Spirits ☐ Ethanol ☐ Iodine ☐ Other (please specify: _____)		

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2.3 Surgical Procedure

Approach	☐ Ventral Midline ☐ Flank Spay ☐ Laparoscopic Spay		
Draping	☐ Single barrier drape ☐ Four corner draping ☐ Other (please specify: _____)		
Skin Incision	Approximate length _____ cm		
Subcutaneous Tissue	☐ Dissect tissue with haemostats ☐ Dissect tissue with scissors		
Celiotomy	☐ Extend incision with scalpel ☐ Extend incision with scissors		
Exteriorizing Uterus	☐ Spay hook ☐ Manually		
Ligating Ovaries	Suspensory Ligament	☐ Do not break ☐ Manually break ☐ Incise with scalpel ☐ Cut with scissors	
	Clamping	☐ No clamps ☐ Two clamps ☐ Three clamps	
	Ligation	☐ One encircling ligature ☐ Two encircling ligatures ☐ Autoligation ☐ Other (please specify: _____)	
	Knot Type	☐ Square ☐ Surgeons ☐ Millers ☐ Transfixation ☐ Other (please specify: _____) ☐ NA	
	Suture Type	☐ Swaged Needle ☐ Reel ☐ NA	
	Suture Material	☐ Monocryl ☐ Vicryl ☐ PDS ☐ Chromic gut ☐ Other (please specify: _____) ☐ NA	
	Suture Size	☐ 4-0 ☐ 3-0 ☐ 2-0 ☐ 0 ☐ 1 ☐ 2 ☐ NA	
Broad Ligament	☐ Do not break ☐ Manually break ☐ Incise with scalpel ☐ Ligate ☐ Other (please specify: _____)		
Ligating Uterus	Clamping	☐ No clamps ☐ Two clamps ☐ Three clamps	
	Ligation	☐ One encircling ligature ☐ Two encircling ligatures ☐ Other (please specify: _____)	
	Knot Type	☐ Square ☐ Surgeons ☐ Millers ☐ Transfixation ☐ Other (please specify: _____)	
	Suture Type	☐ Swaged Needle ☐ Reel ☐ NA	
	Suture Material	☐ Monocryl ☐ Vicryl ☐ PDS ☐ Chromic gut ☐ Other (please specify: _____)	
	Suture Size	☐ 4-0 ☐ 3-0 ☐ 2-0 ☐ 0 ☐ 1 ☐ 2 ☐ NA	
Abdominal Closure	Suture Pattern	☐ Simple Continuous ☐ Simple Interrupted ☐ Cruciate ☐ Other (please specify: _____)	
	Suture Type	☐ Swaged Needle ☐ Reel ☐ NA	
	Suture Material	☐ Monocryl ☐ Vicryl ☐ PDS ☐ Chromic gut ☐ Other (please specify: _____)	
	Suture Size	☐ 4-0 ☐ 3-0 ☐ 2-0 ☐ 0 ☐ 1 ☐ 2 ☐ NA	

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Subcutaneous Tissue Closure	Suture Pattern	☐ Do not close SQ ☐ Simple Continuous ☐ Simple Interrupted ☐ Other (please specify: _____)
	Suture Type	☐ Swaged Needle ☐ Reel ☐ NA
	Suture Material	☐ Monocryl ☐ Vicryl ☐ PDS ☐ Chromic gut ☐ Other (please specify: _____) ☐ NA
	Suture Size	☐ 4-0 ☐ 3-0 ☐ 2-0 ☐ 0 ☐ 1 ☐ 2 ☐ NA
Skin Closure	Suture Pattern	☐ Intradermal ☐ Simple Continuous External ☐ Simple Interrupted External ☐ Other (please specify: _____)
	Suture Type	☐ Swaged Needle ☐ Reel ☐ NA
	Suture Material	☐ Monocryl ☐ Vicryl ☐ PDS ☐ Chromic gut ☐ Other (please specify: _____) ☐ NA
	Suture Size	☐ 4-0 ☐ 3-0 ☐ 2-0 ☐ 0 ☐ 1 ☐ 2 ☐ NA
	Tissue Glue	☐ Yes ☐ No

2.4 Post-Operative Protocols

Drug Reversal	☐ Yes ☐ No ☐ NA (no available reversal agents for anaesthesia protocol)			
Pain Management	Name	Dose (mg/kg)	Route	Number of Days
Drug 1			☐ IM ☐ IV ☐ SQ ☐ PO	
Drug 2			☐ IM ☐ IV ☐ SQ ☐ PO	
Drug 3			☐ IM ☐ IV ☐ SQ ☐ PO	
Drug 4			☐ IM ☐ IV ☐ SQ ☐ PO	
Discharge	☐ Same day ☐ Following day			
E-collar	☐ Yes ☐ No			
Follow-up	☐ Phone call (number of days post-op _____) ☐ Re-check examination (number of days post-op _____) ☐ Suture removal (number of days post-op _____) ☐ None			

2.5 Is this the same technique you were taught during your veterinary training?

☐ Yes ☐ No

2.6 How much is your current method for performing cat spays influenced by your practice's protocols?

☐ Not at all ☐ Very little ☐ Somewhat ☐ Quite a bit ☐ To a great extent

2.7 How long would it take you to perform this surgery from initial incision to final skin suture?

_____ (min)

2.8 Approximately how much would the above procedure cost at your practice (i.e. final amount charged to client)?

\$ _____

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2.9 Additional comments

Section 3: Canine Spay Surgery Procedures

Please answer the following questions as they relate to how you would conduct a routine spay for a healthy 20kg young adult female mixed-breed dog with a BCS of 3/5 that is not currently pregnant, lactating, or in-heat, and has no other known medical problems. For each question, you may select all options that apply, but please try to select only the ones that would apply to this specific patient.

3.1 Pre-Operative Protocols

Patient Assessment	☐ Physical exam ☐ Pre-anaesthetic bloodwork (PCV/TP only) ☐ Pre-anaesthetic bloodwork (Full biochemistry panel)
Admission Time	☐ Morning of procedure ☐ Night before procedure
Surgeon Attire	☐ Surgical cap ☐ Surgical gown ☐ Face mask ☐ Gloves
Surgical Scrub	☐ No scrub ☐ Chlorohexidine scrub ☐ Iodine scrub ☐ Alcohol-based hand rub
Gloving Method	☐ Open gloving ☐ Closed gloving ☐ NA

3.2 Induction and Anaesthesia

IV Catheterization	☐ None ☐ IV Catheter		
Pre-med and/or Induction Drugs	Name	Dose (mg/kg)	Route
Drug 1			☐ IM ☐ IV ☐ SQ
Drug 2			☐ IM ☐ IV ☐ SQ
Drug 3			☐ IM ☐ IV ☐ SQ
Drug 4			☐ IM ☐ IV ☐ SQ
Airway Maintenance	☐ Intubation (w/ Lidocaine splash block) ☐ Intubation (w/out Lidocaine splash block) ☐ Face Mask ☐ None		
Breathing Circuit	☐ None ☐ Re-breathing circuit ☐ Non re-breathing circuit		
Heat Support	☐ None ☐ Bair Hugger ☐ Heated Table ☐ Heating Pad ☐ Other (please specify: _____)		
Patient Monitoring	☐ None ☐ Pulse Oximeter ☐ CO ₂ Monitor (capnograph) ☐ EKG ☐ apAlert ☐ Oesophageal Stethoscope ☐ Regular Stethoscope ☐ Blood Pressure ☐ Other (please specify: _____)		
Fluids	☐ No fluids ☐ IV Fluids ☐ SQ Fluids		

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Maintenance Anaesthesia	☐ None ☐ Isoflurane 2% ☐ Isoflurane 1.5% ☐ Isoflurane 1.0% ☐ Isoflurane 0.5% ☐ IV Maintenance ☐ Other (please specify: _____)
Surgical Site Preparation	☐ Chlorohexidine ☐ Methylated Spirits ☐ Ethanol ☐ Iodine ☐ Other (please specify: _____)

3.3 Surgical Procedure

Approach	☐ Ventral Midline ☐ Flank Spay ☐ Laparoscopic Spay	
Draping	☐ Single barrier drape ☐ Four corner draping ☐ Other (please specify: _____)	
Skin Incision	Approximate length _____ cm	
Subcutaneous Tissue	☐ Dissect tissue with haemostats ☐ Dissect tissue with scissors	
Celiotomy	☐ Extend incision with scalpel ☐ Extend incision with scissors	
Exteriorizing Uterus	☐ Spay hook ☐ Manually	
Ligating Ovaries	Suspensory Ligament	☐ Do not break ☐ Manually break ☐ Incise with scalpel ☐ Cut with scissors
	Clamping	☐ No clamps ☐ Two clamps ☐ Three clamps
	Ligation	☐ One encircling ligature ☐ Two encircling ligatures ☐ Autoligation ☐ Other (please specify: _____)
	Knot Type	☐ Square ☐ Surgeons ☐ Millers ☐ Transfixation ☐ Other (please specify: _____) ☐ NA
	Suture Type	☐ Swaged Needle ☐ Reel ☐ NA
	Suture Material	☐ Monocryl ☐ Vicryl ☐ PDS ☐ Chromic gut ☐ Other (please specify: _____) ☐ NA
	Suture Size	☐ 4-0 ☐ 3-0 ☐ 2-0 ☐ 0 ☐ 1 ☐ 2 ☐ NA
Broad Ligament	☐ Do not break ☐ Manually break ☐ Incise with scalpel ☐ Ligate ☐ Other (please specify: _____)	
Ligating Uterus	Clamping	☐ No clamps ☐ Two clamps ☐ Three clamps
	Ligation	☐ One encircling ligature ☐ Two encircling ligatures ☐ Other (please specify: _____)
	Knot Type	☐ Square ☐ Surgeons ☐ Millers ☐ Transfixation ☐ Other (please specify: _____)
	Suture Type	☐ Swaged Needle ☐ Reel ☐ NA
	Suture Material	☐ Monocryl ☐ Vicryl ☐ PDS ☐ Chromic gut ☐ Other (please specify: _____) ☐ NA
	Suture Size	☐ 4-0 ☐ 3-0 ☐ 2-0 ☐ 0 ☐ 1 ☐ 2 ☐ NA

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Abdominal Closure	Suture Pattern	☐ Simple Continuous ☐ Simple Interrupted ☐ Cruciate ☐ Other (please specify: _____)
	Suture Type	☐ Swaged Needle ☐ Reel ☐ NA
	Suture Material	☐ Monocryl ☐ Vicryl ☐ PDS ☐ Chromic gut ☐ Other (please specify: _____) ☐ NA
	Suture Size	☐ 4-0 ☐ 3-0 ☐ 2-0 ☐ 0 ☐ 1 ☐ 2 ☐ NA
Subcutaneous Tissue Closure	Suture Pattern	☐ Do not close SQ ☐ Simple Continuous ☐ Simple Interrupted ☐ Other (please specify: _____)
	Suture Type	☐ Swaged Needle ☐ Reel ☐ NA
	Suture Material	☐ Monocryl ☐ Vicryl ☐ PDS ☐ Chromic gut ☐ Other (please specify: _____) ☐ NA
	Suture Size	☐ 4-0 ☐ 3-0 ☐ 2-0 ☐ 0 ☐ 1 ☐ 2 ☐ NA
Skin Closure	Suture Pattern	☐ Intradermal ☐ Simple Continuous External ☐ Simple Interrupted External ☐ Other (please specify: _____)
	Suture Type	☐ Swaged Needle ☐ Reel ☐ NA
	Suture Material	☐ Monocryl ☐ Vicryl ☐ PDS ☐ Chromic gut ☐ Other (please specify: _____) ☐ NA
	Suture Size	☐ 4-0 ☐ 3-0 ☐ 2-0 ☐ 0 ☐ 1 ☐ 2 ☐ NA
	Tissue Glue	☐ Yes ☐ No

3.4 Post-Operative Protocols

Drug Reversal	☐ Yes ☐ No ☐ NA (no available reversal agents for anaesthesia protocol)			
Pain Management	Name	Dose (mg/kg)	Route	Number of Days
Drug 1			☐ IM ☐ IV ☐ SQ ☐ PO	
Drug 2			☐ IM ☐ IV ☐ SQ ☐ PO	
Drug 3			☐ IM ☐ IV ☐ SQ ☐ PO	
Drug 4			☐ IM ☐ IV ☐ SQ ☐ PO	
Discharge	☐ Same day ☐ Following day			
E-collar	☐ Yes ☐ No			
Follow-up	☐ Phone call (number of days post-op _____) ☐ Re-check examination (number of days post-op _____) ☐ Suture removal (number of days post-op _____) ☐ None			

3.5 Is this the same technique you were taught during your veterinary training?

☐ Yes ☐ No

How Many Ways to Spay? Survey



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3.6 How much is your current method for performing dog spays influenced by your practice's protocols?

- ☐ Not at all ☐ Very little ☐ Somewhat ☐ Quite a bit ☐ To a great extent

3.7 How long would it take you to perform this surgery from initial incision to final skin suture?

_____ (min)

3.8 Approximately how much would the above procedure cost at your practice (i.e. final amount charged to client)?

\$ _____

3.9 Additional comments

Section 4: Experiences Supervising BVSc Students

4.1 Within the past 12 months, have you supervised any BVSc students on placement at your practice?

- ☐ No (Move to Section 5)
☐ Yes (Continue below)

4.2 How many students did you supervise?

4.3 How often do you supervise students?

- ☐ Daily ☐ Weekly ☐ Monthly ☐ Other (please specify: _____)

4.4 Were the students allowed to perform desexing procedures at your practice under supervision?

- ☐ No

What were the reasons they weren't allowed? (Select all that apply)

- ☐ Liability of having students perform procedures on client-owned animals
☐ Time involved in supervising students through desexing procedures
☐ Not comfortable knowing how to teach surgical skills to students
☐ Inadequate desexing surgical case load when students were there
☐ Concerned about level of student surgical skills and prior knowledge
☐ Concerned about client perception if they knew students performed surgery
☐ Other (please specify: _____)

- ☐ Yes

Which desexing procedures were the students allowed to perform? (Select all that apply)

- ☐ Dog Neuter ☐ Dog Spay ☐ Cat Neuter ☐ Cat Spay

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How would you rate the students' general skills and knowledge in the following areas?

	Very Poor	Poor	Satisfactory	Good	Very Good
Sterile preparation (i.e. scrubbing, gowning, gloving)	☐	☐	☐	☐	☐
Knowledge of surgical landmarks	☐	☐	☐	☐	☐
Knowledge of surgical procedural steps	☐	☐	☐	☐	☐
Knot tying and knot security	☐	☐	☐	☐	☐
Tissue and instrument handling	☐	☐	☐	☐	☐
Selection of suture material and size	☐	☐	☐	☐	☐
General confidence	☐	☐	☐	☐	☐

How often did the following complications occur when students were performing the desexing procedures?

	Never	Rarely	Occasionally	Frequently	Every Time
Break in sterility during procedure	☐	☐	☐	☐	☐
Dropped pedicles	☐	☐	☐	☐	☐
Intra-operative bleeding from uterine or ovarian pedicles	☐	☐	☐	☐	☐
Post-operative bleeding	☐	☐	☐	☐	☐
Post-operative skin infections	☐	☐	☐	☐	☐
Excessive post-operative pain	☐	☐	☐	☐	☐
Other (please specify: _____)	☐	☐	☐	☐	☐

4.5 Would you be more likely to allow students to perform desexing procedures if they had more surgical experience prior to starting 5th year rosters?

☐ No ☐ Yes

Please explain why

4.6 Additional comments

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Section 5: Experiences Supervising New Graduates

5.1 Within the past 12 months, have you supervised or hired any new graduate veterinarians at your practice?

- ☐ No (Move to Section 6)
- ☐ Yes (Continue below)

5.2 How many new graduates did you supervise or hire?

5.3 On a scale of 1 (not important) to 10 (extremely important), how important was their ability to perform desexing procedures in the hiring decision?

5.4 How concerned were you about their skills in the following aspects of desexing surgeries when they first started?

	1 (extremely worried)	2 (quite worried)	3 (indifferent)	4 (reasonably confident)	5 (completely confident)
Post-operative bleeding occurring	☐	☐	☐	☐	☐
Leaving ovarian remnants behind	☐	☐	☐	☐	☐
Taking longer to do a surgery than you think is appropriate.	☐	☐	☐	☐	☐
Performing too large a skin incision	☐	☐	☐	☐	☐
Performing too small a skin incision	☐	☐	☐	☐	☐
Post-operative infection occurring	☐	☐	☐	☐	☐
Ligating ureters	☐	☐	☐	☐	☐
Suture material selection	☐	☐	☐	☐	☐
Herniation	☐	☐	☐	☐	☐
Placing skin sutures too tightly	☐	☐	☐	☐	☐
Post-operative pain in patient	☐	☐	☐	☐	☐
Other (please specify: _____)	☐	☐	☐	☐	☐

5.5 How would you rate the new graduate(s) general skills and knowledge in the following areas?

	Very Poor	Poor	Satisfactory	Good	Very Good
Sterile preparation (i.e. scrubbing, gowning, gloving)	☐	☐	☐	☐	☐
Knowledge of surgical landmarks	☐	☐	☐	☐	☐
Knowledge of surgical procedural steps	☐	☐	☐	☐	☐
Knot tying and knot security	☐	☐	☐	☐	☐
Tissue and instrument handling	☐	☐	☐	☐	☐
Selection of suture material and size	☐	☐	☐	☐	☐
General confidence	☐	☐	☐	☐	☐

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5.6 What level of mentoring or support was offered to help new graduates increase their confidence in performing desexing procedures? (select all that apply)

- ☐ Scrubbed in with them on surgeries until they were competent
- ☐ Visually checked ligatures and closures
- ☐ Always ensured experienced vet was on site to assist if needed
- ☐ None
- ☐ Other (please specify: _____)

5.6 Approximately how many dog and cat desexing surgeries did it take before you felt confident letting the new graduate(s) perform the procedure unassisted?

Dog Neuter _____ Dog Spay _____ Cat Neuter _____ Cat Spay _____

5.7 How long do you think it SHOULD take new graduates to safely perform the following desexing procedures when they first start employment?

Dog Neuter _____(min) Dog Spay _____(min) Cat Neuter _____(min) Cat Spay _____(min)

5.8 What (if anything) could be done to improve the level of mentoring provided to new graduates at your practice to increase confidence and competence in performing desexing surgeries?

Section 6: Additional Comments

Is there anything else you would like to add?

We greatly appreciate your time and participation.

Thank You!

Supplementary Table 2. Surgical attire worn while performing routine dog spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Surgical Cap	Yes	119 (42.2%)	31 (47.0%)	20 (42.6%)	46 (46.0%)	22 (31.9%)	0.234
	No	163 (57.8%)	35 (53.0%)	27 (57.4%)	54 (54.0%)	47 (68.1%)	
Surgical Mask	Yes	76 (27.0%)	15 (22.7%)	14 (29.8%)	33 (33.0%)	14 (20.3%)	0.245
	No	206 (73.0%)	51 (77.3%)	33 (70.2%)	67 (67.0%)	55 (79.7%)	
Surgical Gown	Yes	112 (39.7%)	19 (28.8%)	19 (40.4%)	43 (43.0%)	31 (44.9%)	0.204
	No	170 (60.3%)	47 (71.2%)	28 (59.6%)	57 (57.0%)	38 (55.1%)	
Surgical Gloves	Yes	193 (68.4%)	46 (69.7%)	34 (72.3%)	66 (66.0%)	47 (68.1%)	0.889
	No	89 (31.6%)	20 (30.3%)	13 (27.7%)	34 (34.0%)	22 (31.9%)	

^a Significance of Fisher's exact test

Supplementary Table 3. Surgical attire worn while performing routine cat spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Surgical Cap	Yes	130 (36.0%)	33 (38.4%)	21 (36.8%)	48 (38.7%)	28 (29.8%)	0.532
	No	231 (64.2%)	53 (61.6%)	36 (63.2%)	76 (61.3%)	66 (70.2%)	
Surgical Mask	Yes	77 (21.3%)	18 (20.9%)	14 (24.6%)	30 (24.2%)	15 (16.0%)	0.449
	No	284 (78.9%)	68 (79.1%)	43 (75.4%)	94 (75.8%)	79 (84.0%)	
Surgical Gown	Yes	93 (25.8%)	10 (11.6%)	12 (21.1%)	37 (29.8%)	34 (36.2%)	<0.001
	No	268 (74.2%)	76 (88.4%)	45 (78.9%)	87 (70.2%)	60 (63.8%)	
Surgical Gloves	Yes	245 (67.9%)	57 (66.3%)	40 (70.2%)	87 (70.2%)	61 (64.9%)	0.825
	No	116 (32.1%)	29 (33.7%)	17 (29.8%)	37 (29.8%)	33 (35.1%)	

^a Significance of Fisher's exact test

Supplementary Table 4. Surgical scrub solutions and draping methods used to prepare the surgical site for routine dog spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Chlorohexidene	Yes	255 (90.4%)	61 (92.4%)	43 (91.5%)	86 (86.0%)	65 (94.2%)	0.889
	No	27 (9.6%)	5 (7.6%)	4 (8.5%)	14 (14.0%)	4 (5.8%)	
Methylated Spirits	Yes	150 (41.6%)	34 (51.5%)	31 (66.0%)	49 (49.0%)	36 (52.52%)	0.274
	No	132 (36.6%)	32 (48.5%)	16 (34.0%)	51 (51.0%)	33 (47.8%)	
Ethanol	Yes	39 (13.8%)	6 (9.1%)	4 (8.5%)	16 (16.0%)	15 (21.7%)	0.250
	No	243 (86.2%)	60 (90.9%)	43 (91.5%)	84 (84.0%)	56 (81.2%)	
Iodine	Yes	31 (10.9%)	7 (10.6%)	4 (8.5%)	14 (14.0%)	6 (8.7%)	0.703
	No	251 (89.1%)	59 (89.4%)	43 (91.5%)	86 (86.0%)	63 (91.3%)	
Tincture	Yes	15 (5.3%)	3 (4.5%)	4 (8.5%)	4 (4.0%)	4 (5.8%)	0.659
	No	267 (94.7%)	63 (95.5%)	43 (91.5%)	96 (96.0%)	65 (94.2%)	
Draping Method	Single Barrier	246 (87.2%)	63 (95.5%)	41 (87.2%)	83 (83.0%)	59 (85.5%)	0.035
	Four-corner Drape	29 (10.2%)	3 (4.5%)	4 (8.5%)	16 (16.0%)	6 (8.7%)	
	Other	7 (2.8%)	0 (0.0%)	2 (4.3%)	1 (1.0%)	4 (5.8%)	

^a Significance of Fisher's exact test

Supplementary Table 5. Surgical scrub solutions and draping methods used to prepare the surgical site for routine cat spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Chlorohexidene	Yes	322 (89.2%)	78 (90.7%)	52 (91.2%)	111 (89.5%)	81 (86.2%)	0.825
	No	39 (10.8%)	8 (9.3%)	5 (8.8%)	13 (10.5%)	13 (13.8%)	
Methylated Spirits	Yes	192 (53.2%)	48 (55.8%)	34 (59.6%)	64 (51.6%)	46 (48.9%)	0.576
	No	169 (46.8%)	38 (44.2%)	23 (40.4%)	60 (48.4%)	46 (48.9%)	
Ethanol	Yes	43 (11.9%)	7 (8.1%)	5 (8.8%)	16 (12.9%)	15 (16.0%)	0.374
	No	318 (88.1%)	79 (91.9%)	52 (91.2%)	108 (87.1%)	79 (84.0%)	
Iodine	Yes	47 (13.0%)	10 (11.6%)	5 (8.8%)	17 (13.7%)	15 (16.0%)	0.630
	No	314 (87.0%)	76 (88.4%)	52 (91.2%)	107 (86.3%)	79 (84.0%)	
Tincture	Yes	15 (4.2%)	2 (2.3%)	5 (8.8%)	4 (3.2%)	4 (4.3%)	0.310
	No	346 (95.8%)	84 (97.7%)	52 (91.2%)	120 (96.8%)	90 (95.7%)	
Draping Method	Single Barrier	343 (95.0%)	83 (96.5%)	53 (93.0%)	118 (95.2%)	89 (94.7%)	0.212
	Four-corner Drape	13 (3.6%)	3 (3.5%)	1 (1.8%)	4 (3.2%)	5 (5.3%)	
	Other	5 (1.4%)	0 (0.0%)	3 (5.3%)	2 (1.6%)	0 (0.0%)	

^a Significance of Fisher's exact test

Supplementary Table 6. Surgical approach used to isolate the uterus in routine dog spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Surgical Approach ^b	Flank	3 (1.1%)	0 (0.0%)	0 (0.0%)	1 (1.0%)	2 (2.9%)	0.773
	Ventral Midline	278 (98.6%)	66 (100.0%)	47 (100.0%)	98 (98.0%)	67 (97.1%)	
Dissecting S/C Tissue	Haemostats	20 (7.1%)	4 (6.1%)	5 (10.6%)	4 (4.0%)	7 (10.1%)	0.289
	Scissors	262 (92.9%)	62 (93.9%)	42 (89.4%)	96 (96.0%)	62 (89.9%)	
Extending Celiotomy Incision	Scalpel	38 (13.5%)	5 (7.6%)	4 (8.5%)	18 (18.0%)	11 (15.9%)	0.174
	Scissors	244 (86.5%)	61 (92.4%)	43 (91.5%)	82 (82.0%)	58 (84.1%)	
Exteriorising Uterus	Manually	147 (51.4%)	40 (60.6%)	26 (55.3%)	50 (50.0%)	31 (44.9%)	0.320
	Spay Hook	135 (47.9%)	26 (39.4%)	21 (44.7%)	50 (50.0%)	38 (55.1%)	

^a Significance of Fisher's exact test^b One respondent graduated 11–24 years used laparoscopic spays

Supplementary Table 7. Surgical approach used to isolate the uterus in routine cat spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Surgical Approach	Flank	107 (29.6%)	12 (14.0%)	17 (29.8%)	41 (33.1%)	37 (39.4%)	<0.001
	Ventral Midline	254 (70.3%)	74 (86.0%)	40 (70.2%)	83 (66.9%)	57 (60.6%)	
Dissecting S/C Tissue	Haemostats	23 (6.4%)	2 (2.3%)	3 (5.3%)	8 (6.5%)	10 (10.6%)	0.152
	Scissors	338 (93.6%)	84 (97.7%)	54 (94.7%)	116 (93.5%)	84 (89.4%)	
Extending Celiotomy Incision	Scalpel	54 (15.0%)	13 (15.1%)	7 (12.3%)	16 (12.9%)	18 (19.1%)	0.278
	Scissors	307 (85.0%)	73 (84.9%)	50 (87.7%)	108 (87.1%)	76 (80.9%)	
Exteriorising Uterus	Manually	48 (13.3%)	18 (20.9%)	6 (10.5%)	12 (9.7%)	12 (12.8%)	0.072
	Spay Hook	313 (86.7%)	68 (79.1%)	51 (89.5%)	112 (90.3%)	82 (87.2%)	

^a Significance of Fisher's exact test

Supplementary Table 8. Techniques for ligating and removing the ovaries in routine dog spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Suspensory Ligament	Do not break	40 (14.2%)	8 (12.1%)	2 (4.3%)	15 (15.0%)	15 (21.7%)	0.005
	Manually break	222 (78.7%)	57 (86.4%)	43 (91.5%)	79 (79.0%)	43 (62.3%)	
	Cut with scissors	10 (3.5%)	0 (0.0%)	0 (0.0%)	3 (3.0%)	7 (10.1%)	
	Incise with scalpel	10 (3.5%)	1 (1.5%)	2 (4.3%)	3 (3.0%)	4 (5.8%)	
Clamping	No Clamps	3 (1.1%)	1 (1.5%)	0 (0.0%)	1 (1.0%)	1 (1.4%)	0.293
	Two Clamps	162 (57.4%)	42 (63.6%)	31 (66.0%)	50 (50.0%)	39 (56.5%)	
	Three Clamps	117 (41.4%)	23 (34.8%)	16 (34.0%)	49 (49.0%)	29 (42.0%)	
Ligature	Autoligation	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	<0.001
	One encircling	88 (31.2%)	10 (15.2%)	13 (27.7%)	35 (35.0%)	30 (43.5%)	
	Two encircling	191 (67.7%)	56 (84.8%)	34 (72.3%)	65 (65.0%)	36 (52.2%)	
	Other	3 (1.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (4.3%)	
Knot Type ^b	None	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.256
	Square	69 (24.5%)	18 (27.3%)	14 (29.8%)	26 (26.0%)	11 (15.9%)	
	Surgeon's	186 (66.0%)	51 (77.3%)	34 (72.3%)	56 (56.0%)	45 (65.2%)	
	Miller's	54 (19.1%)	15 (22.7%)	8 (17.0%)	18 (18.0%)	13 (18.8%)	
	Transfixation	78 (27.7%)	28 (42.4%)	9 (19.1%)	30 (30.0%)	11 (15.9%)	
Suture Type	Not Applicable	3 (1.1%)	2 (3.0%)	0 (0.0%)	1 (1.0%)	0 (0.0%)	0.826
	Swaged-on	68 (24.1%)	17 (25.8%)	12 (25.5%)	26 (26.0%)	13 (18.8%)	
	Reel	211 (74.8%)	48 (72.7%)	35 (74.5%)	73 (73.0%)	55 (79.7%)	
Suture Material	Not applicable	1 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.345
	Chromic gut	64 (22.7%)	10 (15.2%)	8 (17.0%)	25 (25.0%)	21 (30.4%)	
	Polyglecaprone 25	9 (3.2%)	3 (4.5%)	2 (4.3%)	3 (3.0%)	1 (1.4%)	
	Polyglactin 910	53 (18.8%)	11 (16.7%)	5 (10.6%)	21 (21.0%)	16 (23.2%)	
	Polydioxanone	121 (42.9%)	34 (51.5%)	25 (53.2%)	40 (40.0%)	22 (31.9%)	
	Polyglycolic acid	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	Other	34 (12.1%)	11 (16.7%)	5 (10.6%)	21 (21.0%)	16 (23.2%)	
Suture Size	Not applicable	2 (0.7%)	0 (0.0%)	1 (2.1%)	0 (0.0%)	1 (1.4%)	0.361

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2	14 (5.0%)	2 (3.0%)	2 (4.3%)	5 (5.0%)	5 (7.2%)
1	22 (7.8%)	2 (3.0%)	4 (8.5%)	7 (7.0%)	9 (13.0%)
0	101 (35.8%)	19 (28.8%)	17 (36.2%)	40 (40.0%)	25 (36.2%)
2-0	128 (45.4%)	39 (59.1%)	22 (46.8%)	44 (44.0%)	23 (33.3%)
3-0	11 (3.9%)	3 (4.5%)	1 (2.1%)	3 (3.0%)	4 (5.8%)
4-0	4 (1.4%)	1 (1.5%)	0 (0.0%)	1 (1.0%)	2 (2.9%)

^a Significance of Fisher's exact test

^b Totals > 100% since some respondents who used two encircling ligatures used different knot types for each

Supplementary Table 9. Techniques for ligating and removing the ovaries in routine cat spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Suspensory Ligament	Do not break	238 (65.9%)	61 (70.9%)	43 (75.4%)	78 (62.9%)	56 (59.6%)	0.522
	Manually break	83 (23.0%)	21 (24.4%)	10 (17.5%)	28 (22.6%)	24 (25.5%)	
	Cut with scissors	16 (4.4%)	1 (1.2%)	1 (1.8%)	7 (5.6%)	7 (7.4%)	
	Incise with scalpel	24 (6.6%)	3 (3.5%)	3 (5.3%)	11 (8.9%)	7 (7.4%)	
Clamping	No Clamps	24 (6.6%)	4 (4.7%)	5 (8.8%)	5 (4.0%)	10 (10.6%)	0.214
	Two Clamps	267 (74.0%)	71 (82.6%)	42 (73.7%)	92 (74.2%)	62 (66.0%)	
	Three Clamps	70 (19.4%)	11 (12.8%)	10 (17.5%)	27 (21.8%)	22 (23.4%)	
Ligature	Autoligation	11 (3.0%)	3 (3.5%)	2 (3.5%)	3 (2.4%)	3 (3.2%)	0.009
	One encircling	264 (73.1%)	54 (62.8%)	46 (80.7%)	103 (83.1%)	61 (64.9%)	
	Two encircling	83 (23.0%)	29 (33.7%)	8 (14.0%)	17 (13.7%)	29 (30.9%)	
	Other	3 (0.8%)	0 (0.0%)	1 (1.8%)	1 (0.8%)	1 (1.1%)	
Knot Type ^b	Not applicable	10 (2.8%)	1 (1.2%)	3 (5.3%)	4 (3.2%)	2 (2.1%)	0.495
	Square	107 (29.6%)	32 (37.2%)	19 (33.3%)	33 (26.6%)	23 (24.5%)	0.215
	Surgeon's	239 (66.2%)	55 (64.0%)	37 (64.9%)	83 (66.9%)	64 (68.1%)	0.936
	Miller's	33 (9.1%)	11 (12.8%)	7 (12.3%)	8 (6.5%)	7 (7.4%)	0.347
	Transfixation	30 (8.3%)	10 (11.6%)	2 (3.5%)	9 (7.3%)	9 (9.6%)	0.362
Suture Type	Not applicable	22 (6.1%)	4 (4.7%)	2 (3.5%)	10 (8.1%)	6 (6.4%)	0.831
	Swaged-on	73 (20.2%)	20 (23.3%)	12 (21.1%)	24 (19.4%)	17 (18.1%)	
	Reel	266 (73.2%)	62 (72.1%)	43 (75.4%)	90 (72.6%)	71 (75.5%)	
Suture Material	Not applicable	10 (2.8%)	0 (0.0%)	2 (3.5%)	4 (3.2%)	4 (4.3%)	<0.001
	Chromic gut	77 (21.3%)	13 (15.1%)	10 (17.5%)	26 (21.0%)	28 (29.8%)	
	Poliglecaprone 25	27 (7.5%)	3 (3.5%)	10 (17.5%)	11 (8.9%)	3 (3.2%)	
	Polyglactin 910	92 (25.5%)	19 (22.1%)	7 (12.3%)	41 (33.1%)	25 (26.6%)	
	Polydioxanone	130 (36.0%)	43 (50.0%)	26 (45.6%)	37 (29.8%)	24 (25.5%)	
	Polyglycolic acid	20 (5.5%)	7 (8.1%)	2 (3.5%)	3 (2.4%)	8 (8.5%)	
	Other	8 (2.2%)	0 (0.0%)	1 (1.8%)	3 (2.4%)	4 (4.3%)	
	Other	8 (2.2%)	0 (0.0%)	1 (1.8%)	3 (2.4%)	4 (4.3%)	
Suture Size	Not applicable	14 (3.9%)	0 (0.0%)	2 (3.5%)	5 (4.05)	3 (3.2%)	0.132

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2	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.1%)
1	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.1%)
0	12 (3.3%)	2 (2.3%)	1 (1.8%)	4 (3.2%)	5 (5.3%)
2-0	95 (26.3%)	15 (17.4%)	12 (21.1%)	35 (28.2%)	33 (35.1%)
3-0	233 (64.5%)	66 (76.7%)	41 (71.9%)	79 (63.7%)	47 (50.0%)
4-0	5 (1.4%)	2 (2.3%)	1 (1.8%)	1 (0.8%)	1 (1.1%)

^a Significance of Fisher's exact test

^b Totals > 100% since some respondents who used two encircling ligatures used different knot types for each

Supplementary Table 10. Techniques for ligating and removing the uterus in routine dog spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Broad Ligament	Do Not Break	14 (5.0%)	0 (0.0%)	2 (4.3%)	8 (8.0%)	4 (5.8%)	0.421
	Manually Break	175 (62.1%)	40 (60.6%)	31 (66.0%)	62 (62.0%)	42 (60.9%)	
	Ligate	70 (24.8%)	20 (30.3%)	10 (21.3%)	25 (25.0%)	15 (21.7%)	
	Incise or Cut	2 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (2.9%)	
	Other	21 (7.4%)	6 (9.1%)	4 (8.5%)	5 (5.0%)	6 (8.7%)	
Clamping	No Clamps	13 (4.6%)	0 (0.0%)	2 (4.3%)	5 (5.0%)	6 (8.7%)	0.347
	Two Clamps	168 (59.6%)	46 (69.7%)	30 (63.8%)	54 (54.0%)	38 (55.1%)	
	Three Clamps	101 (35.8%)	20 (30.3%)	15 (31.9%)	41 (41.0%)	25 (36.2%)	
Ligature	One encircling	62 (22.0%)	5 (7.6%)	7 (14.9%)	27 (27.0%)	23 (33.3%)	0.047
	Two encircling	152 (53.9%)	43 (65.2%)	26 (55.3%)	49 (49.0%)	34 (49.3%)	
	Other	68 (24.1%)	18 (27.3%)	14 (29.8%)	24 (24.0%)	12 (17.4%)	
Knot Type ^b	Square Surgeon's	60 (21.3%)	18 (27.3%)	11 (23.4%)	20 (20.0%)	11 (15.9%)	0.424
		178 (63.1%)	48 (72.7%)	32 (68.1%)	56 (56.0%)	42 (60.9%)	0.143
	Miller's	46 (16.3%)	10 (15.2%)	8 (17.0%)	14 (14.0%)	14 (20.3%)	0.734
	Transfixation	139 (49.3%)	48 (72.7%)	27 (57.4%)	45 (45.0%)	19 (27.5%)	< 0.001
Suture Type	Not applicable	2 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (2.9%)	0.330
	Swaged-on	74 (26.2%)	16 (24.2%)	15 (31.9%)	29 (29.0%)	14 (20.3%)	
	Reel	206 (73.0%)	50 (75.8%)	32 (68.1%)	71 (71.0%)	53 (76.8%)	
Suture Material	Chromic gut	63 (22.3%)	11 (16.7%)	8 (17.0%)	25 (25.0%)	19 (27.5%)	0.132
	Poliglecaprone 25	12 (4.3%)	4 (6.1%)	3 (6.4%)	4 (4.0%)	1 (1.4%)	
	Polyglactin 910	53 (18.8%)	11 (16.7%)	5 (10.6%)	21 (21.0%)	16 (23.2%)	
	Polydioxanone	127 (45.0%)	34 (51.5%)	26 (55.3%)	42 (42.0%)	25 (36.2%)	
	Polyglycolic acid	20 (7.1%)	5 (.6%)	2 (4.3%)	7 (7.0%)	6 (8.7%)	
	Other	7 (2.5%)	1 (1.5%)	3 (6.4%)	1 (1.0%)	2 (2.9%)	
Suture Size	Not applicable	4 (1.4%)	0 (0.0%)	1 (2.1%)	0 (0.0%)	3 (4.3%)	0.210
	2	14 (5.0%)	3 (4.5%)	3 (6.4%)	4 (4.0%)	4 (5.8%)	
	1	24 (8.5%)	5 (7.6%)	4 (8.5%)	6 (6.0%)	9 (13.0%)	
	0	101 (35.8%)	16 (24.2%)	15 (31.9%)	43 (43.0%)	27 (39.1%)	
	2-0	128 (45.4%)	40 (60.6%)	22 (46.8%)	45 (45.0%)	21 (30.4%)	
	3-0	7 (2.5%)	1 (1.5%)	2 (4.3%)	1 (1.0%)	3 (4.3%)	
	4-0	4 (1.4%)	1 (1.5%)	0 (0.0%)	1 (1.0%)	2 (2.9%)	

^a Significance of Fisher's exact test^b Totals > 100% since some respondents who used two encircling ligatures used different knot types for each

Supplementary Table 11. Techniques for ligating and removing the uterus in routine cat spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Broad Ligament	Do Not Break	67 (18.6%)	13 (15.1%)	12 (21.1%)	29 (23.4%)	13 (13.8%)	0.041
	Manually Break	277 (76.7%)	71 (82.6%)	45 (78.9%)	91 (73.4%)	70 (74.5%)	
	Ligate	6 (1.7%)	1 (1.2%)	0 (0.0%)	1 (0.8%)	4 (4.3%)	
	Incise or Cut	10 (2.8%)	1 (1.2%)	0 (0.0%)	2 (1.6%)	7 (7.4%)	
	Other	1 (0.3%)	0 (0.0%)	0 (0.0%)	1 (0.8%)	0 (0.0%)	
Clamping	No Clamps	45 (12.5%)	9 (10.5%)	9 (15.8%)	15 (12.1%)	12 (12.8%)	0.613
	Two Clamps	250 (69.3%)	67 (77.9%)	37 (64.9%)	87 (70.2%)	59 (62.8%)	
	Three Clamps	60 (16.6%)	9 (10.5%)	10 (17.5%)	21 (16.9%)	20 (21.3%)	
	Other	6 (1.7%)	1 (1.2%)	1 (1.8%)	1 (0.8%)	3 (3.2%)	
Ligature	One encircling	213 (59.0%)	38 (44.2%)	36 (63.2%)	87 (70.2%)	52 (55.3%)	0.025
	Two encircling	108 (29.9%)	39 (45.3%)	14 (24.6%)	25 (20.2%)	30 (31.9%)	
	Other	40 (11.1%)	9 (10.5%)	7 (12.3%)	12 (9.7%)	12 (12.8%)	
Knot Type ^b	Square Surgeon's	96 (26.6%)	28 (32.6%)	19 (33.3%)	29 (23.4%)	20 (21.3%)	0.179
	Miller's	239 (66.2%)	60 (69.8%)	37 (64.9%)	81 (65.3%)	61 (64.9%)	
	Transfixation	34 (9.4%)	9 (10.5%)	5 (8.8%)	11 (8.9%)	9 (9.6%)	
Suture Type	Not applicable	83 (23.0%)	33 (38.4%)	13 (22.8%)	21 (16.9%)	16 (17.0%)	< 0.001
	Swaged-on	75 (20.8%)	19 (22.1%)	11 (19.3%)	27 (21.8%)	18 (19.1%)	
	Reel	273 (75.6%)	63 (73.3%)	45 (78.9%)	92 (74.2%)	73 (77.7%)	
Suture Material	Chromic gut	13 (3.6%)	4 (4.7%)	1 (1.8%)	5 (4.0%)	3 (3.2%)	0.031
	Polyglactin 910	21 (5.8%)	2 (2.3%)	7 (12.3%)	9 (7.3%)	3 (3.2%)	
	Polydioxanone	94 (26.0%)	20 (23.3%)	9 (15.8%)	38 (30.6%)	27 (28.7%)	
	Polyglycolic acid	133 (36.8%)	43 (50.0%)	25 (43.9%)	40 (32.3%)	25 (26.6%)	
	Other	24 (6.6%)	6 (7.0%)	3 (5.3%)	6 (4.8%)	9 (9.6%)	
	Other	9 (2.5%)	2 (2.3%)	3 (5.3%)	1 (0.8%)	3 (3.2%)	
Suture Size	Not applicable	8 (2.2%)	2 (2.3%)	1 (1.8%)	0 (0.0%)	2 (2.1%)	0.428
	2	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.1%)	
	1	3 (0.8%)	0 (0.0%)	0 (0.0%)	1 (0.8%)	2 (2.1%)	
	0	13 (3.6%)	3 (3.5%)	1 (1.8%)	4 (3.2%)	5 (5.3%)	
	2-0	115 (31.9%)	22 (25.6%)	15 (26.3%)	43 (34.7%)	35 (37.2%)	
	3-0	217 (60.1%)	57 (66.3%)	39 (68.4%)	75 (60.5%)	46 (48.9%)	
	4-0	4 (1.1%)	2 (2.3%)	1 (1.8%)	0 (0.0%)	1 (1.1%)	

^a Significance of Fisher's exact test^b Totals > 100% since some respondents who used two encircling ligatures used different knot types for each

Supplementary Table 12. Techniques for closing the abdomen, subcutaneous tissue, and skin in routine dog spays by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Abdomen Suture Pattern	Simple Continuous	212 (75.2%)	54 (81.8%)	40 (85.1%)	79 (79.0%)	39 (56.5%)	0.006
	Simple Interrupted	51 (18.1%)	12 (18.2%)	5 (10.6%)	16 (16.0%)	18 (26.1%)	
	Cruciate	7 (2.5%)	0 (0.0%)	1 (2.1%)	2 (2.0%)	4 (5.8%)	
	Other	12 (4.3%)	0 (0.0%)	1 (2.1%)	3 (3.0%)	5 (7.2%)	
Suture Type	Swaged-on	131 (46.5%)	25 (37.9%)	23 (48.9%)	53 (53.0%)	30 (43.5%)	0.175
	Reel	151 (53.5%)	41 (62.1%)	24 (51.1%)	47 (47.0%)	39 (56.5%)	
Suture Material	Chronic gut	1 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.4%)	0.059
	Poliglecaprone 25	11 (3.9%)	5 (7.6%)	2 (4.3%)	4 (4.0%)	0 (0.0%)	
	Polyglactin 910	80 (28.4%)	13 (19.7%)	10 (21.3%)	30 (30.0%)	27 (39.1%)	
	Polydioxanone	163 (57.8%)	41 (62.1%)	30 (63.8%)	59 (59.0%)	33 (47.8%)	
	Polyglycolic acid	16 (5.7%)	5 (7.6%)	1 (2.1%)	4 (4.0%)	6 (8.7%)	
	Other	11 (3.9%)	2 (3.0%)	4 (8.5%)	3 (3.0%)	2 (2.9%)	
Suture Size	Not applicable	1 (0.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.703
	2	5 (1.8%)	2 (3.0%)	0 (0.0%)	1 (1.0%)	2 (2.9%)	
	1	14 (5.0%)	2 (3.0%)	4 (8.5%)	2 (2.0%)	6 (8.7%)	
	0	104 (36.9%)	24 (36.4%)	18 (38.3%)	36 (36.0%)	26 (37.7%)	
	2-0	137 (48.6%)	32 (48.5%)	23 (48.9%)	54 (54.0%)	28 (40.6%)	
	3-0	17 (6.0%)	5 (7.6%)	2 (6.0%)	6 (6.0%)	4 (5.8%)	
	4-0	4 (1.4%)	1 (1.5%)	0 (0.0%)	1 (1.0%)	2 (2.9%)	
S/C Tissue Suture Pattern	Do not close	11 (3.9%)	1 (1.5%)	1 (2.1%)	5 (5.0%)	4 (5.8%)	0.940
	Simple Continuous	257 (91.9%)	61 (92.4%)	45 (95.7%)	89 (89.0%)	62 (89.9%)	
	Simple Interrupted	11 (3.9%)	3 (4.5%)	1 (2.1%)	5 (5.0%)	2 (2.9%)	
	Other	3 (1.1%)	1 (1.5%)	0 (0.0%)	1 (1.0%)	1 (1.4%)	
Suture Type	Not applicable	10 (3.5%)	1 (1.5%)	1 (2.1%)	5 (5.0%)	3 (4.3%)	0.909
	Suture on a reel	172 (61.0%)	43 (65.2%)	29 (61.7%)	55 (55.0%)	45 (65.2%)	
	Swaged needle	100 (35.5%)	22 (33.3%)	17 (36.2%)	40 (40.0%)	21 (30.4%)	
Suture Material	Not applicable	12 (4.3%)	2 (3.0%)	1 (2.1%)	6 (6.0%)	3 (4.3%)	0.029

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	Chronic gut	20 (7.1%)	1 (1.5%)	2 (4.3%)	10 (10.0%)	7 (10.1%)	
	Polyglecaprone 25	23 (8.2%)	8 (12.1%)	2 (4.3%)	10 (10.0%)	3 (4.3%)	
	Polyglactin 910	82 (29.1%)	14 (21.2%)	12 (25.5%)	30 (30.0%)	26 (37.3%)	
	Polydioxanone	107 (37.9%)	32 (48.5%)	24 (51.1%)	35 (35.0%)	16 (23.2%)	
	Polyglycolic acid	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	Other	38 (13.5%)	9 (13.6%)	6 (12.8%)	9 (9.0%)	14 (20.3%)	
Suture Size	Not applicable	10 (3.5%)	1 (1.5%)	1 (2.1%)	5 (5.0%)	3 (3.0%)	0.455
	2	1 (0.4%)	1 (1.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	1	4 (1.4%)	1 (1.5%)	0 (0.0%)	1 (1.0%)	2 (2.0%)	
	0	31 (11.0%)	9 (13.6%)	7 (14.9%)	7 (7.0%)	8 (8.0%)	
	2-0	153 (54.3%)	42 (63.6%)	23 (48.9%)	50 (50.0%)	38 (38.0%)	
	3-0	82 (29.1%)	12 (18.2%)	16 (34.0%)	36 (36.0%)	18 (18.0%)	
	4-0	1 (0.4%)	0 (0.0%)	0 (0.0%)	1 (1.0%)	0 (0.0%)	
Skin Suture Pattern	Simple Continuous External	10 (3.5%)	1 (1.5%)	2 (4.3%)	6 (6.0%)	1 (1.4%)	0.457
	Simple Interrupted External	109 (38.7%)	27 (40.9%)	15 (31.9%)	39 (39.0%)	28 (40.6%)	
	Intradermal	80 (28.4%)	15 (22.7%)	17 (36.2%)	27 (27.0%)	21 (30.4%)	
	Cruciate External	68 (24.1%)	19 (28.8%)	11 (23.4%)	26 (26.0%)	12 (17.4%)	
	Other Pattern	15 (5.3%)	4 (6.1%)	2 (4.3%)	2 (2.0%)	7 (10.1%)	
	Not applicable	5 (1.8%)	1 (1.5%)	0 (0.0%)	2 (2.0%)	2 (2.9%)	
Suture Type	Suture on a reel	211 (74.8%)	53 (80.3%)	39 (83.0%)	68 (68.0%)	51 (73.9%)	0.343
	Swaged needle	66 (23.4%)	12 (18.2%)	8 (17.0%)	30 (30.0%)	16 (23.2%)	
Suture Material	Chronic gut	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.012
	Polyglecaprone 25	47 (16.7%)	4 (6.1%)	7 (14.9%)	24 (24.0%)	12 (17.4%)	
	Polyglactin 910	33 (11.7%)	8 (12.1%)	5 (10.6%)	10 (10.0%)	10 (14.5%)	
	Polydioxanone	35 (12.4%)	10 (15.2%)	8 (17.0%)	9 (9.0%)	8 (11.6%)	
	Polyglycolic acid	6 (2.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (8.7%)	
	Polyamide	106 (37.6%)	32 (48.5%)	18 (38.3%)	32 (32.0%)	24 (34.8%)	
	Nylon	50 (17.7%)	11 (16.7%)	8 (17.0%)	23 (23.0%)	8 (11.6%)	
	Other	5 (1.8%)	1 (1.5%)	1 (2.1%)	2 (2.0%)	1 (1.4%)	
Suture Size	Not applicable	1 (0.4%)	0 (0.0%)	0 (0.0%)	1 (1.0%)	0 (0.0%)	0.225

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	2	5 (1.8%)	2 (3.0%)	0 (0.0%)	1 (1.0%)	2 (2.9%)	
	1	2 (0.7%)	2 (3.0%)	0 (0.0%)	1 (1.0%)	2 (2.9%)	
	0	33 (11.7%)	5 (7.6%)	7 (14.9%)	14 (14.0%)	7 (10.1%)	
	2-0	141 (50.0%)	37 (56.1%)	26 (55.3%)	40 (40.0%)	38 (55.1%)	
	3-0	88 (31.2%)	17 (25.8%)	14 (29.8%)	41 (41.0%)	16 (23.2%)	
	4-0	9 (3.2%)	3 (4.5%)	0 (0.0%)	2 (2.0%)	4 (5.8%)	
Tissue Glue	Yes	25 (8.9%)	9 (13.6%)	5 (10.6%)	11 (11.0%)	0 (0.0%)	0.204
	No	257 (91.1%)	57 (86.4%)	42 (89.4%)	89 (89.0%)	69 (100%)	

^a Significance of Fisher's exact test

Supplementary Table 13. Techniques for closing the body wall, subcutaneous tissue, and skin in routine cat spays by veterinarians categorised by number of years since graduation.

		All Respondent s N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Abdomen							
Suture Pattern	Simple	253 (70.1%)	73 (84.9%)	48 (84.2%)	86 (69.4%)	46 (48.9%)	<0.001
	Continuous						
	Simple	75 (20.8%)	10 (11.6%)	7 (12.3%)	26 (21.0%)	32 (34.0%)	
	Interrupted						
	Cruciate	16 (4.4%)	2 (2.3%)	2 (3.5%)	7 (5.6%)	5 (5.3%)	
	Other	17 (4.7%)	1 (1.2%)	0 (0.0%)	5 (4.0%)	11 (11.7%)	
Suture Type	Swaged-on Reel	251 (69.5%) 110 (30.5%)	24 (27.9%) 62 (72.1%)	17 (29.8%) 40 (70.2%)	46 (37.1%) 78 (62.9%)	23 (24.5%) 71 (75.5%)	0.246
Suture Material	Chromic gut	31 (8.6%)	4 (4.7%)	3 (5.3%)	11 (8.9%)	13 (13.8%)	0.005
		Poliglecaprone 25	25 (6.9%)	6 (7.0%)	5 (8.8%)	12 (9.7%)	
	Polyglactin 910	117 (32.4%)	20 (23.3%)	13 (22.8%)	46 (37.1%)	38 (40.4%)	
	Polydioxanone	145 (40.2%)	43 (50.0%)	30 (52.6%)	45 (36.3%)	27 (28.7%)	
	Polyglycolic acid	25 (6.9%)	8 (9.3%)	3 (5.3%)	4 (3.2%)	10 (10.6%)	
	Other	18 (5.0%)	5 (5.8%)	3 (5.3%)	6 (4.8%)	4 (4.3%)	
Suture Size	Not applicable	5 (1.4%)	3 (3.5%)	0 (0.0%)	1 (0.8%)	1 (1.1%)	0.088
		2	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	1	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.1%)	
	0	9 (2.5%)	3 (3.5%)	0 (0.0%)	3 (2.4%)	3 (3.2%)	
	2-0	98 (27.1%)	16 (18.6%)	15 (26.3%)	31 (25.0%)	36 (38.3%)	
	3-0	237 (65.7%)	61 (70.9%)	40 (70.2%)	87 (70.2%)	49 (52.1%)	
4-0	10 (2.8%)	2 (2.3%)	2 (3.5)%	2 (1.6%)	4 (4.3%)		
S/C Tissue							
Suture Pattern	Do not close	145 (40.2%)	30 (34.9%)	33 (57.9%)	55 (44.4%)	27 (28.7%)	0.046
		Simple	162 (44.9%)	45 (52.3%)	18 (31.6%)	53 (42.7%)	
	Continuous						
	Simple	39 (10.8%)	7 (8.1%)	4 (7.0%)	12 (9.7%)	16 (17.0%)	
	Interrupted						
	Other	15 (4.2%)	4 (4.7%)	2 (3.5%)	4 (3.2%)	5 (5.3%)	
Suture Type	Not applicable	139 (38.5%)	25 (29.1%)	29 (50.9%)	49 (39.5%)	23 (24.5%)	0.060
		Suture on a reel	158 (43.8%)	42 (48.8%)	20 (35.1%)	47 (37.9%)	
	Swaged needle	64 (17.7%)	16 (18.6%)	6 (10.5%)	22 (17.7%)	20 (21.3%)	
Suture Material	Not applicable	84 (23.3%)	19 (22.1%)	11 (19.3%)	35 (28.2%)	19 (20.2%)	0.049

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	Chromic gut	25 (6.9%)	3 (3.5%)	3 (5.3%)	9 (7.3%)	10 (10.6%)	
	Poliglecaprone 25	22 (6.1%)	6 (7.0%)	4 (7.0%)	10 (8.1%)	2 (2.1%)	
	Polyglactin 910	84 (23.3%)	18 (20.9%)	10 (17.5%)	29 (23.4%)	27 (28.7%)	
	Polydioxanone	87 (24.1%)	28 (32.6%)	11 (19.3%)	26 (21.0%)	22 (23.4%)	
	Polyglycolic acid	15 (4.2%)	4 (4.7%)	2 (3.5%)	3 (2.4%)	6 (6.4%)	
	Other	44 (12.2%)	8 (9.3%)	16 (28.1%)	12 (9.7%)	8 (8.5%)	
Suture Size	Not applicable	133 (36.8%)	29 (33.7%)	31 (54.4%)	47 (37.9%)	26 (27.7%)	<0.001
	2	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	1	1 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.1%)	
	0	3 (0.3%)	1 (1.2%)	0 (0.0%)	1 (0.8%)	1 (1.1%)	
	2-0	49 (13.6%)	8 (9.3%)	3 (5.3%)	12 (9.7%)	26 (27.7%)	
	3-0	159 (44.0%)	48 (55.8%)	19 (33.3%)	60 (48.4%)	32 (34.0%)	
	4-0	16 (4.4%)	0 (0.0%)	4 (7.0%)	4 (3.2%)	8 (8.5%)	
Skin							
Suture Pattern	Simple	15 (4.2%)	3 (3.5%)	0 (0.0%)	5 (4.0%)	7 (7.4%)	0.124
	Continuous						
	External	140 (38.8%)	32 (37.2%)	21 (36.8%)	50 (40.3%)	37 (39.4%)	
	Simple						
	Interrupted						
	External						
	Intradermal	113 (31.3%)	24 (27.9%)	22 (38.6%)	41 (33.1%)	26 (27.7%)	
	Cruciate	65 (18.0%)	22 (25.6%)	12 (21.1%)	21 (16.9%)	10 (10.6%)	
	External						
	Other Pattern	28 (7.8%)	5 (5.8%)	2 (3.5%)	7 (16.9%)	14 (14.9%)	
Suture Type	Not applicable	9 (2.5%)	1 (1.2%)	1 (1.8%)	3 (5.6%)	4 (4.3%)	0.604
	Suture on a reel	267 (74.0%)	63 (73.3%)	46 (80.7%)	90 (72.6%)	68 (72.3%)	
	Swaged needle	85 (23.5%)	22 (25.6%)	10 (17.5%)	31 (25.0%)	22 (23.4%)	
Suture Material	Not applicable	6 (1.7%)	4 (4.7%)	0 (0.0%)	0 (0.0%)	2 (2.1%)	0.162
	Chromic gut	4 (1.1%)	0 (0.0%)	0 (0.0%)	2 (1.6%)	2 (2.1%)	
	Poliglecaprone 25	56 (15.5%)	6 (7.0%)	9 (15.8%)	28 (22.6%)	13 (13.8%)	
	Polyglactin 910	52 (14.4%)	11 (12.8%)	8 (14.0%)	21 (16.9%)	12 (12.8%)	
	Polydioxanone	44 (12.2%)	14 (16.3%)	8 (14.0%)	13 (10.5%)	9 (9.6%)	
	Polyglycolic acid	9 (2.5%)	2 (2.3%)	1 (1.8%)	1 (0.8%)	5 (5.3%)	
	Polyamide	128 (35.5%)	36 (41.9%)	21 (36.8%)	38 (30.6%)	33 (35.1%)	
	Nylon	58 (16.1%)	13 (15.1%)	9 (15.8%)	20 (16.1%)	16 (17.0%)	
	Other	4 (1.1%)	0 (0.0%)	1 (1.8%)	1 (0.8%)	2 (2.1%)	
Suture Size	Not applicable	7 (1.9%)	4 (4.7%)	2 (3.5%)	0 (0.0%)	1 (1.1%)	0.588

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	2	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	1	2 (0.6%)	1 (1.2%)	0 (0.0%)	0 (0.0%)	1 (1.1%)	
	0	4 (1.1%)	1 (1.2%)	0 (0.0%)	3 (2.4%)	0 (0.0%)	
	2-0	71 (19.7%)	13 (15.1%)	12 (21.1%)	21 (16.9%)	25 (26.6%)	
	3-0	259 (71.7%)	64 (74.4%)	43 (75.4%)	91 (73.4%)	61 (64.9%)	
	4-0	18 (5.0%)	3 (3.5%)	2 (3.5%)	7 (5.6%)	6 (6.4%)	
Tissue Glue	Yes	35 (9.7%)	10 (11.6%)	9 (15.8%)	14 (11.3%)	2 (2.1%)	0.014
	No	326 (90.3%)	76 (88.4%)	48 (84.2%)	110 (88.7%)	92 (97.9%)	

^a Significance of Fisher's exact test

Supplementary Table 14. Post-operative protocols for routine dog spays reported by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Discharge Time	Same Day	259 (91.8%)	63 (95.5%)	46 (97.9%)	89 (89.0%)	61 (88.4%)	0.365
	Following Day	16 (5.7%)	2 (3.0%)	1 (2.1%)	9 (9.0%)	4 (5.8%)	
	Other	7 (2.5%)	1 (1.5%)	0 (0.0%)	2 (2.0%)	4 (5.8%)	
Elizabethan Collar	Yes	132 (46.8%)	42 (63.6%)	30 (63.8%)	49 (49.0%)	13 (18.8%)	< 0.001
	No	150 (53.3%)	24 (36.4%)	17 (36.3%)	51 (51.0%)	48 (69.6%)	
Post-Operative Phone Call	Yes	133 (47.2%)	24 (36.4%)	20 (42.6%)	54 (54.0%)	35 (50.7%)	0.126
	No	149 (52.8%)	42 (63.6%)	27 (57.4%)	46 (46.0%)	34 (49.3%)	
Re-check Examination	Yes	115 (40.8%)	28 (42.4%)	21 (44.7%)	44 (44.0%)	22 (31.9%)	0.379
	No	167 (59.2%)	38 (57.6%)	26 (55.3%)	56 (56.0%)	47 (68.1%)	
Suture Removal	Yes	207 (73.4%)	52 (78.8%)	37 (78.7%)	71 (71.0%)	47 (68.1%)	0.421
	No	75 (26.6%)	14 (21.2%)	10 (21.3%)	29 (29.0%)	22 (31.9%)	

^a Significance of Fisher's exact test

Supplementary Table 15. Post-operative care protocols for routine cat spays reported by veterinarians categorised by number of years since graduation.

Variable	Level	All Respondents N = 361	≤5 years N = 86	6–10 years N = 57	11–24 years N = 124	≥25 years N = 94	P-value ^a
Discharge Time	Same Day	317 (87.8%)	77 (89.5%)	53 (93.0%)	105 (84.7%)	82 (87.2%)	0.228
	Following Day	10 (2.8%)	0 (0.0%)	1 (1.8%)	7 (5.6%)	2 (2.1%)	
	Other	34 (9.4%)	9 (10.5%)	3 (5.3%)	11 (8.9%)	7 (7.4%)	
Elizabethan Collar	Yes	111 (30.7%)	33 (38.4%)	23 (40.4%)	41 (33.1%)	14 (14.9%)	< 0.001
	No	250 (69.3%)	53 (61.6%)	34 (59.6%)	83 (66.9%)	80 (85.1%)	
Post-Operative Phone Call	Yes	147 (40.7%)	28 (32.6%)	20 (35.1%)	59 (47.6%)	40 (42.6%)	0.135
	No	214 (59.3%)	58 (67.4%)	37 (64.9%)	65 (52.4%)	54 (57.4%)	
Re-check Examination	Yes	123 (34.1%)	28 (32.6%)	22 (38.6%)	44 (35.5%)	29 (30.9%)	0.763
	No	238 (65.9%)	58 (67.4%)	35 (61.4%)	80 (64.5%)	65 (69.1%)	
Suture Removal	Yes	243 (67.3%)	63 (73.3%)	40 (70.2%)	75 (60.5%)	65 (69.1%)	0.235
	No	118 (32.7%)	23 (26.7%)	17 (29.8%)	49 (39.5%)	29 (30.9%)	

^a Significance of Fisher's exact test