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Abstract

Objectives The aim of the study was to investigate the effects of age and/or surgical approach on perioperative wound complication following ovariohysterectomy (OHE).

Methods A retrospective search of perioperative monitoring records from a shelter desexing program was conducted to identify cats that underwent OHE between 1 June 2010 and 31 December 2012 inclusive. A wound complication was defined as gross observation of inflammation or wound dehiscence at the surgical site in the 5 day postoperative period. Cases were grouped according to age (≤ 12 weeks or > 12 weeks) and surgical approach (flank or midline). Stratified analyses were conducted to evaluate the association between surgical approach and wound complications, after adjusting for age. Mantel–Haenszel adjusted risk ratio, Cochran–Mantel–Haenszel test statistic and their 95% confidence intervals were presented.

Results A total of 312 cases met the study criteria. The overall wound complication risk was low (6.09%) and was not related to age. A midline approach was associated with a 4.59-times increased risk of wound complication, compared with a flank approach in cats up to 12 weeks of age ($P = 0.015$) but not in older cats.

Conclusions and relevance These findings support the practice of prepubertal desexing for cats.

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Introduction

The management of unowned domestic cat (*Felis catus*) populations is a global problem that raises issues for individual cat welfare and conservation of native wildlife. The remarkable reproductive success of this species is a major factor in the ability of cats to colonise diverse environments. The onset of puberty in females can be as early as 12 weeks and a single female cat can produce 40 kittens per year.¹ It is estimated that between 75% and 97% of cats in a population need to be desexed to stabilise numbers.^{1,2} Shelter organisations began desexing cats prior to puberty > 30 years ago.³ Early-age desexing removes the responsibility for desexing from owners who, despite financial incentives, frequently fail to return the cat for surgery,³ while still allowing rehoming at a young age to optimise socialisation. There is increasing evidence that early-age desexing is not only safe in the short and long term, but also offers advantages, including reduced surgical time

and rapid recovery, over the traditional age of 6 months or older.^{4,5} Many national and international shelter, welfare and veterinary organisations now endorse early-age desexing, including the Royal Society of the Prevention of Cruelty to Animals, the International Society of Feline Medicine and the American Veterinary Medical Association. Despite these factors, recent surveys indicate that attitudes within the veterinary profession towards early-age desexing are variable.^{6,7}

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The choice of surgical approach to ovariohysterectomy (OHE) shows regional variation, with a flank approach favoured in the UK (96%), and a midline approach in the US.^{8,9} Benefits described for midline OHE include better visualisation and reduced postoperative pain scores, whereas a flank approach may offer shorter surgery time and reduced risk of hypothermia, herniation or evisceration. Evidence to support one approach over the other is limited, particularly in prepubertal cats.

The aim of this study was to determine whether there was an association between age and surgical approach, individually or combined, and perioperative wound complication in cats undergoing OHE.

Materials and methods

Cases were recruited from the Cat Protection Society (CPS) of New South Wales desexing program. Surgeries were performed at four veterinary clinics (A–D). A single surgical approach, either flank (clinic A) or midline (clinics B–D) was used at each location. Only healthy cats with a body weight of 1 kg or more were accepted in this program. Following anaesthetic recovery, cats were returned to the CPS for postoperative monitoring. Cats were examined twice daily and findings, including wound assessment, were recorded in a manual database. The database was searched retrospectively to identify cats that underwent OHE between 1 June 2010 and 31 December 2012 inclusive. Cases were included if the following information was available: age at the time of surgery; clinic where surgery was performed; and complete records from at least 1 day prior to surgery to 5 days postsurgery inclusive. Cases were excluded if surgery was performed by a veterinary student under the supervision of a veterinarian. A wound complication was recorded when the description of the surgical site included any of the following terms: redness; swelling; heat; pain; exudation (grouped as inflammation); or wound dehiscence in the 5 day postoperative period.

Data were exported into a CSV file and analysed using Statulator, an online statistical program (<http://statulator.com/>). Initially, descriptive analyses were conducted, including the creation of frequency tables for categorical variables and the calculation of summary statistics for age to understand the distribution of variables. To evaluate the association of age with wound complication, cats were classified into groups according to age: those aged ≤ 12 weeks and those aged > 12 weeks. Contingency tables of age and surgical approach with wound complication (yes/no) were created and χ^2 analyses were conducted to evaluate crude associations between them. Stratified analyses were then conducted to evaluate association of surgical approach with wound complication after adjusting for age. Mantel–Haenszel adjusted risk ratio and Cochran–Mantel–Haenszel test statistic were reported.

Results

In total, 506 cats underwent OHE during the study period. Of these, 194 were excluded because the clinic was not identified ($n = 145$), recording of wound status was incomplete ($n = 45$) or surgery was performed by a student under supervision ($n = 4$). In total, 312 cases met the inclusion criteria (Table 1). The mean age at the time of surgery was 41 weeks (median 12 weeks, range 5–468 weeks). Wound complication was identified in 19 cases (6.09%). In 18 of these, signs were consistent with inflammation at the surgical site, while wound dehiscence was identified in a single 12-week-old patient that had an OHE via a midline approach. Age at desexing was not a risk factor for wound complication; there was no significant difference in the development of wound complications in cats up to 12 weeks of age compared with older cats ($P = 0.38$) (Table 2). Considering all cases, regardless of age, a midline approach was associated with 2.95-fold increased risk of wound complication compared with a flank approach ($P = 0.011$). When a stratified analysis by age was performed (Table 3), a midline approach was 4.59-times more likely than a flank approach to result in wound complication in cats up to 12 weeks of age ($P = 0.015$). However, in cases over 12 weeks of age, there was no association between surgical approach and the risk of wound complication ($P = 0.22$).

Discussion

Definitions of early-age desexing are variable.^{5,10} We used a cut-off of ≤ 12 weeks to ensure that cats were prepubertal; of 33 cats < 1 year of age that were pregnant at desexing in a UK study, two were < 4 months old.¹¹ Others have demonstrated that early-age desexing from 6 weeks of age carries no increased risks to the patient.^{9–11} There are several factors that require particular attention when performing OHE in paediatric patients compared with older cats. These include avoiding hypoglycaemia by fasting for a much shorter period (3–4 h) and offering food immediately on recovery, as well as preventing hypothermia. A comprehensive review of early-age desexing, including suitable anaesthetic protocols, has recently been published.¹¹

The overall incidence of perioperative wound inflammation (6%) or dehiscence ($< 0.003\%$) in this study was low, as expected for a routine procedure performed in healthy animals.⁴ Our findings support previous studies that demonstrate no increase in the short-term complication rate following the desexing of young cats compared with older cats. In fact, higher overall complication rates are reported in cats > 6 months compared with those aged < 12 weeks.⁴

Previous prospective, randomised studies comparing flank vs midline approaches to OHE have produced conflicting results and none have investigated prepubertal patients specifically.^{8,12,13} Some of the suggested pros and

Table 1 Frequency tables of categorical variables

Variables	Category	Count	Percent
Age	≤12 weeks	162	51.9
	>12 weeks	150	48.1
Surgical approach	Flank	239	76.6
	Midline	73	23.4
Clinic	A (flank)	239	76.0
	B (midline)	3	1.0
	C (midline)	60	19.2
	D (midline)	10	3.2
Wound complication	No	293	93.9
	Yes	19	6.1

Table 2 χ^2 and odds ratios based on crude association of each explanatory variable with development of wound complication

Variables	Category	Wound complication, n (%)		Total	Risk ratio (95% CI)	P value
		Yes	No			
Age	≤12 weeks	8 (4.9)	154 (95.1)	162	1.00	0.380
	>12 weeks	11 (7.3)	139 (92.7)	150	1.49 (0.61–3.59)	
Surgical approach	Flank	10 (4.2)	229 (95.8)	239	1.00	0.011
	Midline	9 (12.3)	64 (87.7)	73	2.95 (1.24–6.97)	

CI = confidence interval

Table 3 Stratified analysis of association between surgical approach and wound complications, after adjusting for age

Age (weeks)*	Surgical approach	Wound complication			Stratified risk ratio (95% CI)	P value
		Yes	No	Total		
≤12	Flank	4	129	133	4.59 (1.22–17.29)	0.015
	Midline	4	25	29		
>12	Flank	6	100	106	2.01 (0.65–6.24)	0.220
	Midline	5	39	44		

*Adjusted risk ratio and 95% confidence interval (CI) 2.75 (1.18–6.43); Cochran–Mantel–Haenszel statistic 5.80; P value 0.016

cons of a flank vs a midline approach to OHE may become redundant when they are applied to prepubertal patients. For example, reduced abdominal and bursal fat allows enhanced visualisation and more accurate vessel haemostasis during OHE by either approach in kittens.^{8,10} The observation here that a midline approach increased the risk of wound complication in cats up to 12 weeks, but not in older cats, is interesting. Of previous studies, two were conducted in teaching institutions. The first, investigating ovarioectomy in 38 cats of any age, found that a midline approach carried a higher risk of wound swelling, while a flank approach was more painful on palpation.¹³ A second study of 66 cats aged 6 months to 10 years found a greater risk of wound tenderness and discharge with a flank compared with a midline approach.¹² Surgeries were performed by veterinary

students and the overall wound complication rate, as reported by owners, was high (42%) with severe complications noted only after midline surgery. In a separate study, Burrow et al compared flank and midline approaches to OHE in 20 cats (median age 10 months) performed by a single experienced surgeon and found that the flank approach was marginally quicker but was associated with a tendency to be more painful than a midline approach.¹⁴ It is important to note that kittens are less likely than adult cats to demonstrate visual indicators of pain, so early-age desexing protocols should include interactive pain assessment such as wound palpation.¹⁵

There are limitations in the current study design. Data collection was retrospective so protocols were not standardised. This was partially addressed by excluding cases

with incomplete wound descriptions. A flank approach was used by a single clinic so we cannot exclude that factors other than approach contributed to our observations. However, the overall wound complication rate was low and OHE is a standard procedure so any effect from other factors is suggested to be low.

Conclusions

These findings add to the evidence base supporting a cultural change to embrace the practice of early-age desexing as standard for feline patients.

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Conflict of interest The Cat Protection Society of NSW is a welfare organisation specialising in rehoming cats, with the majority being adolescents. Their policy states all cats must be desexed prior to rehoming, and they favour early-age desexing in cats. The Cat Protection Society provided patient data and the fee for online access only. Cat Protection Society was not involved in study design or analysis.

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