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Risk Factors Associated with Post-operative Wound Complications in the Animal Birth Control Program, Chiang Mai Municipality, Thailand, 2017

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Abstract

While surgical sterilization is applied in the animal birth control program, Chiang Mai Municipality, with limited resources under field condition, there was concern about complications in post-operative wound healing. This study aimed to describe the incidence of wound complication after surgical sterilization and evaluate the associated risk factors. The investigators conducted a cross-sectional study on the owners and animals participated in the program from March to June 2017. The investigators recorded wound complications and possible risk factors for seven days after the operation, and assessed those factors using risk ratios (RR) with 95% level of confidence. Out of total 141 owners of 252 animals included in this study, 15 (6.0%) animals had post-operative wound complications. Animal receiving cefazolin injection prior to the operation was 0.36 times (95% CI = 0.14–0.97) likely to have wound healing complication than those received penicillin with dihydrostreptomycin. Complete course of either antibiotic or anti-inflammatory drug after the operation could protect animals from wound complications (RR = 0.15; 95% CI = 0.05–0.43). Among female animals, midline incision had lower incidence of complication than flank incision (RR = 0.23, 95% CI = 0.07-0.77). In conclusion, there were 6% of post-operative wound complications in this program. Monitoring of wound complications should be included in every surgical sterilization campaign.

Keywords: Sterilization, wound, complication, Chiang Mai Municipality, Thailand

Introduction

Approximately, 60,000 people die from rabies each year worldwide.[1] Control of dog and cat population is an effective strategy for reducing susceptible population to rabies, and creating a sustainable rabies control program.[2] Although the best method of animal population control is surgical sterilization, the surgical operation requires experienced veterinary surgeons, clean instruments and effective post-operative management.

Post-operative management should aim to prevent and control of wound swelling, inflammation and infection. Improper wound management can lead to complications such as scrotal swelling in male dogs, pyometra in female animals and post-operative infection.[3] While standard guideline protocols for surgical sterilization are available,[4] the Wide Veterinary Service (WVS) developed a surgical protocol, aiming to improve animal welfare and reduce complications after operation[5].

Sterilization is also the main method for dog and cat population control in Chiang Mai Province of Thailand. The WVS surgical protocol was adopted by the Chiang Mai Municipality as a basis to achieve good rabies control measures. The procedure includes hand scrubbing, scrubbing of incision site, sterilization of instruments and administering antibiotic or anti-inflammatory drugs post-operatively.

However, due to limitation of surgical instruments, time and personnel resources in field conditions, all sterilization procedures may not fully meet the standard protocol, and the veterinary officers need to follow up all animal owners to assess post-operative wound healing and complications.

Hence, the aims of this study were to describe the incidence of wound complication in dogs and cats after the surgical sterilization that were performed under the animal birth control program in Chiang Mai Municipality, and evaluate risk factors of post-operative wound complications.

Methods

A cross-sectional observational study was performed by collecting data of the animals sterilized under the animal birth control program in Chiang Mai Municipality from March to June 2017.

In brief, the protocol for surgical sterilization under the animal birth control program included:

1. Physical examination, including measuring weight, rectal temperature and dehydration status
2. Antibiotic prophylaxis before operation (Either intramuscular procaine penicillin 12,000 IU/kg with dihydrostreptomycin 20 mg/kg (PSLA) or cefazolin injection 20mg/kg at least 15 minutes before the operation was used in this study.)
3. Anesthesia by propofol 4mg/kg or tiletamine-zolazepam 5mg/kg
4. Scrubbing of surgeon's hands by chlorhexidine scrub solution and cleaning with alcohol
5. Autoclaving instrument or disinfection by alkyl dimethyl ammonium chloride due to limited number of autoclave machine
6. Midline or flank incision sites for female animals, and scrotal incision in cats and pre-scrotal incision in dogs for male animals
7. Giving antibiotic (Cephalaxin 10mg/kg) or anti-inflammatory drug (Carprofen 4mg/kg) for post-operative treatment

Prior to the operation, health status of animals and other risk factors were assessed, and condition during the sterilization was recorded using the anesthesia monitoring form and a questionnaire. Risk factors were categorized into before, during and after the operation (Table 1).

Wound healing status and complications were assessed using telephone interview on the seventh day after the operation. Broken wounds, wound swelling, having pus or exudate were considered as a post-operative wound complication. Animals that died, those received antimicrobial or anti-inflammation drugs by another source, or the animal owners who could not be contacted were excluded from the analysis.

Descriptive statistics were used to quantify the wound complications. Risk ratio (RR) were calculated to measure associations between wound complications and factors with 95% confidence interval (CI). Statistical analyses was performed using Epi Info version 7.2.1.0[6].

Results

Information was collected from 149 owners for total 260 animals. Eight animals from eight owners were excluded due to loss of contact, receiving antimicrobial drugs by private animal clinics and death. Thus, total 252 animals (122 dogs and 130 cats) and 141 owners were included in the analysis (Table 2).

Table 1. Risk factors assessed before, during and after the surgical sterilization in the animal birth control program, Chiang Mai Municipality, Chiang Mai Province, Thailand, 2017

Condition	Risk item	Risk factor
Pre-operation	Animal signalment	Species, weight, gender and age
	Animal husbandry	Free-roaming or restricted
	Physical examination	Temperature, dehydration status and color of mucous membrane
During operation	Surgeon's hand scrubbing	
	Sterilization of instruments	Autoclave or disinfection
	Prophylaxis	Procaine penicillin with dihydrostreptomycin or cefazolin
	Type of operation	Castration or ovariohysterectomy
	Surgeon	Thai or foreign veterinarian
	Surgical site	Frank or midline incision, only for female animals
	Duration of operation	
	Frequency of anesthetic drug given to maintain animals in surgical anesthetic stage	Unconsciousness, amnesia, immobility and unresponsive to surgical stimulation
Post-operation	Type of drug given by the owner	
	Completing of oral drug administration by the owner	Antibiotic or anti-inflammation drug

Table 2. Baseline characteristics of animals undergone the surgical sterilization in the animal birth control program, Chiang Mai Municipality, Chiang Mai Province, Thailand, March-June 2017

Characteristic	Number (Percent)	Mean (Range)
Owner (n=141)		
Gender		
Male	46 (32.6)	
Female	95 (67.4)	
Age (year)		45.6 (18-73)
Animal (n=252)		
Type		
Dog	122 (48.4)	
Cat	130 (51.6)	
Gender		
Male	63 (25.0)	
Female	189 (75.0)	
Age (month)		24.8 (2-120)
Body weight (kg)		7.1 (1.1-24.3)
Dog		11.1 (2.4-24.3)
Cat		3.4 (1.1-5.9)

Out of 252 animals, 48.4% (122/252) were dogs and the rests were cat. About 75.0% (189/252) were female animals. The overall incidence of wound complications on the post-operative day seven was 15 (6.0%). Wound complications were found in 5.3% (10/189) of female and 7.9% (5/63) of male animals. The common wound complications included serous exudate (33.3%), followed by broken wound (26.7%) and broken wound with pus exudate (20.0%) (Table 3).

Table 3. Post-operative wound complications in the animal birth control program, Chiang Mai Municipality, Chiang Mai Province, Thailand, March-June 2017

Description	Number	Percent
Wound complication	15	6.0
Broken wound	4	26.7
Having pus	1	6.67
Broken wound with pus	3	20.0
Serous exudate	5	33.3
Swollen wound	1	6.7
Swollen wound with serous discharge	1	6.7
Animal type		
Dog	8	53.3
Cat	7	46.7
Animal gender		
Female	10	66.7
Male	5	35.3

Two factors were significantly associated with wound complications. Animals that were given with cefazolin before the surgical operation were 0.36 times (95% CI=0.14-0.97) likely to have wound complications than animals that received penicillin/streptomycin. Wound complications in animals that were provided with full dose of drug after the operation were 85% less than animals that received the drug partially (RR=0.15, 95% CI=0.05-0.43) (Table 4). For female animals, having a midline incision had a significantly lower incidence of wound complications than a flank incision (RR=0.23, 95% CI=0.07-0.77). Other risk factors including disinfection methods, operation/anesthesia duration and body weight of animals showed some association with the wound complications but non-statistically significant.

Discussion

Our study found that post-operative complications occurred in 6% of animals after the surgical sterilization while wound complications occurred equally in dogs and cats. Two primary protective factors identified for wound complications were type of prophylactic antibiotic and continuous administration of the drug until seven days after the surgical operation.

The incidence of wound complications after sterilization operation among animals in Thailand had never been published. The incidence in this study was similar to a study in Philadelphia, Pennsylvania[7]. Flank incision is practiced by some veterinary surgeons in Thailand as they believed that it is easier to remove ovaries and reduce wound complications. However, this study revealed that flank incision in female animals was associated with increased incidence of wound complications five times higher than the midline incision. This result was also similar to a report in the United Kingdom[8]. Thus, the finding of this study can be used to support the use of midline incisions to reduce wound complications in the future.

In addition, the use of appropriate antibiotic prophylaxis treatment is crucial to protect animal from any wound complication. We found higher prophylaxis effect by cefazolin injection to post-operative wound complications, compared with penicillin/streptomycin injection. The results of this study also supported the conclusion from the report of the Companion Animal Control Project of Chiang Mai Municipality in 2015, stating that penicillin and streptomycin susceptibility to *Staphylococcus* spp. and *Bacillus* spp., which were commonly found around the incisional site, was reducing and cefazolin had a better prophylaxis effect than penicillin and streptomycin[9].

Table 4. Post-operative wound complications and associated factors of animals undergone the surgical sterilization in the animal birth control program, Chiang Mai Municipality, Chiang Mai Province, Thailand, March-June 2017

Factor	Number/total	Percent	Risk ratio	95% CI
Pre-operation				
Animal husbandry (n=249)				
Restrict housing	2/49	4.1	0.63	0.15-2.69
Free roaming	13/200	6.5	Reference	
Animal type (n=252)				
Dog	8/122	6.6	1.22	0.46-3.26
Cat	7/130	5.4	Reference	
Age in year (n=207)				
0-1	5/93	5.4	0.88	0.29-2.67
>1	7/114	6.1	Reference	
Physical examination				
Body weight in kg (n=252)				
0-10	10/183	5.5	0.75	0.27-2.13
>10	5/69	7.2	Reference	
Temperature in °C (n=137)				
0-38	1/27	3.7	0.81	0.10-6.69
>38	5/110	4.5	Reference	
Dehydration (n=142)				
Normal hydration	6/126	4.8	NA	NA
Dehydration	0/16	0		
Mucous membrane (n=219)				
Pale	2/30	6.7	0.97	0.23-4.08
Pink	13/189	6.9	Reference	
During operation				
Surgeon type (n=232)				
Thai veterinarian	12/188	6.4	0.94	0.28-3.18
Foreign veterinarian	3/44	6.8	Reference	
Prophylaxis (n=252)				
Cefazolin	7/178	3.9	0.36	0.14-0.97
Penicillin/streptomycin	8/74	10.8	Reference	
Type of operation (n=252)				
Castration	5/63	7.9	1.50	0.53-4.22
Ovariohysterectomy	10/189	5.3	Reference	
Midline	4/141	2.8	0.23	0.07-0.77
Flank	6/48	12.5	Reference	
Maintenance frequency (n=252)				
No	9/133	6.8	1.34	0.49-3.66
Yes	6/119	5.0	Reference	
1-5 times	5/100	5.0	0.95	0.12-7.68
>5 times	1/19	5.3	Reference	
Hand scrub (n=252)				
Yes	8/184	4.3	0.42	0.16-1.12
No	7/68	10.3	Reference	
Duration of operation (n=158)				
<30 minutes	4/102	3.9	0.44	0.12-1.57
>30 minutes	5/56	8.9	Reference	
Sterilization (n=252)				
Autoclave	9/199	4.5	0.40	0.15-1.07
Disinfection	6/53	11.3	Reference	
Post-operation				
Post-operative drug (n=252)				
Anti-inflammatory	5/81	6.2	1.06	0.37-2.99
Antimicrobial	10/171	5.8	Reference	
Drug history (n=242)				
Continuous and complete	12/243	4.9	0.15	0.05-0.43
Incomplete	3/9	33.3	Reference	

Oral administration of antibiotic after operation did not reduce the incidence of wound complication, comparing with anti-inflammatory drug in this study.

A previous study also revealed that antimicrobial drug administration did not show effects on the post-operative wound complications if the operations were performed under clean procedures by the experienced surgeons[10]. Hence, giving antibiotics for animals after operation might not be necessary if the operation was performed under appropriate aseptic condition.

In some other studies, the risk factors such as using liquid chemical disinfectant instead of autoclaving instruments[11], operation duration and body weight of animals[12], and anesthesia duration[12-14] were proved to be associated with the post-operative wound complications, however not supported by this study.

The complete drug dosage (either antibiotic or anti-inflammatory) was also identified to be a protective factor for wound complication. This effect might derive directly from the drug itself or a complete dose that served as a proxy for post-operative care which might be a confounder for the association between wound complication and complete drug dosage. However, this issue was not determined in this study.

The information on post-operative care practices by animal owners was not gathered since the information was collected by telephone interview. Thus, post-operative care practices should be studied in more detailed.

This study was performed in complementary to follow up the program of animal health after surgical operation. As the study did not aim to prove specific factors associated with the post-operative wound complications, appropriate randomization was not applied. However, the results revealed useful information that was needed for further interventions.

In conclusion, 6% of post-operative wound complications was found in the animal birth control program of Chiang Mai Municipality. In the future, wound complications could be prevented by administering the appropriate antibiotic just before the operation and applying midline incision in female animals. Owners' compliance with the spay-neuter program to support rabies control relies on a high success rate of the control program and low incidence of post-operative complications. Continuous monitoring of wound complications after the surgical sterilization is necessary to ensure as part of the animal birth control program in Chiang Mai Municipality. Future studies could be carried out to understand the effects of post-operation care by animal owners and wound complications.

Suggested Citation

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