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# A systematic review of criteria used to report complications in soft tissue and oncologic surgical clinical research studies in dogs and cats

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## Abstract

**Objective:** To evaluate reporting of surgical complications and other adverse events in clinical research articles describing soft tissue and oncologic surgery in dogs and cats.

**Study design:** Systematic literature review.

**Sample:** English-language articles describing soft tissue and oncologic surgeries in client-owned dogs and cats published in peer-reviewed journals from 2013 to 2016.

**Methods:** CAB, AGRICOLA, and MEDLINE databases were searched for eligible articles. Article characteristics relevant to complications were abstracted and summarized, including reported events, definitions, criteria used to classify events according to severity and time frame, and relevant citations.

**Results:** One hundred fifty-one articles involving 10 522 animals were included. Canine retrospective case series of dogs predominated. Ninety-two percent of articles mentioned complications in study results, but only 7.3% defined the term *complication*. Articles commonly described complications according to time frame and severity, but terminology and classification criteria were highly variable, conflicting between studies, or not provided. Most (58%) reported complications could have been graded with a published veterinary adverse event classification scheme, although common intraoperative complications were notable exceptions.

**Conclusion:** Definitions and criteria used to classify and report soft tissue and oncologic surgical complications are often absent, incomplete, or contradictory among studies.

**Clinical significance:** Lack of consistent terminology contributes to inadequate communication of important information about surgical complications. Standardization of terminology and consistency in severity scoring will improve comparative evaluation of clinical research results.

The abstract from this study was presented at the AVCS Surgery Summit; October 12-14, 2017; Indianapolis, Indiana.

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## 1 | INTRODUCTION

Complications and other adverse outcomes are inevitable in veterinary surgical practice. When using the medical literature to inform best practices, clinicians require resources that provide balanced assessments of procedural harms as well as benefits.<sup>1</sup> It is also essential that veterinarians are able to compare outcomes across different studies and techniques.<sup>2</sup>

Standardized data collection methods, reporting practices, and definitions of common adverse events (AE) are useful to facilitate clear communication of research results and allow for meaningful comparisons across research studies.<sup>1-5</sup> In human surgical practice, several systems for classifying intraoperative and postoperative complications have been developed to report clinical research results.<sup>5-8</sup> However, efforts to standardize criteria for defining and classifying surgical complications are limited in veterinary medicine. In 2010, Cook et al<sup>3</sup> suggested broad criteria for categorizing time frame and severity of clinical orthopedic surgical outcomes, but it is unknown to what extent these criteria have been adopted by authors or whether they are applicable to soft tissue and oncologic surgery. We recently reported that wide adoption of a standardized AE definition and grading scheme, the Veterinary Cooperative Oncology Group Common Toxicity Criteria for Adverse Events (VCOG-CTCAE),<sup>9</sup> improved the quality of harms reporting in veterinary chemotherapeutic clinical trials.<sup>10</sup> In the same study, we found that the quality of harms reporting in surgical oncology studies was poor; no studies cited the Cook reporting guidelines, VCOG-CTCAE, or any other standardized criteria to catalogue surgery-related complications, and many studies failed to mention complications at all.

The primary objective of this study was to systematically review how complications were reported in recently published clinical research studies of soft tissue and oncologic surgical interventions in dogs and cats. We sought to quantify how often the terms *complication* and *adverse event* were defined and to report the definitions used. We also sought to quantify how often complications were defined, graded, and categorized according to time frame and severity and to report the criteria used. Secondary objectives were to identify relevant time frames for reporting soft tissue and oncologic surgical complications and to estimate the proportion of reported complications that could have been defined and graded with the VCOG-CTCAE. Finally, we sought to compile a list of reported complications that may be used to develop new tools or to update existing systems designed to measure surgical complication outcomes.

## 2 | MATERIALS AND METHODS

Original research reports in peer-reviewed English-language scientific journals from 2013 to 2016 that studied diagnostic

or therapeutic soft tissue surgical interventions in live client-owned dogs and cats were eligible for inclusion. Additional inclusion criteria were: the study objective was to describe or compare cases of animals undergoing surgical procedures, an observational or experimental clinical research design was used, sample of >3 animals, and all animals had naturally occurring indications for surgery. Articles were excluded when they involved neurologic and intraocular surgery or when surgeries performed were not directly related to the study objectives. We conducted a search for potentially eligible articles on May 17, 2017 using the Ovid interface search string (dog/ or cat/ or canine/ or feline) AND (surgery/ or surgical) limit to yr = "2013-2016" to search CAB, AGRICOLA, and MEDLINE databases. Article titles, journals, authors, and links to article full texts were downloaded into database management software by using Ovid. Resulting articles were screened for eligibility by one investigator (CMF) on the basis of titles, abstracts, and full texts when required. For each potentially eligible article identified, two investigators (CMF, MAG) read the title, abstract, and full text to determine whether the article met study inclusion criteria.

Article data were abstracted in duplicate by two investigators with discrepancies resolved by review and consensus. Publication year, journal, species, study design, timing of data collection (retrospective or prospective), sample size, surgical intervention, and disease process were abstracted from each eligible article. For each article, the following information was collected: whether the terms *complication* or *adverse event* were explicitly defined in the study, whether any specific complications or AE were explicitly defined, whether complications or AE were categorized by time frame and whether definitions of terms used to describe time frames were provided, and whether complications or AE were graded by severity and whether definitions of terms and categories used to grade severity were provided. All reported complications and AE, definitions, and supporting citations were cataloged. The principal summary measures were frequencies of reporting complication-related items. Summary statistics were calculated.

## 3 | RESULTS

Database searches returned 6233 records of articles, of which 1958 were excluded as duplicates. Among the remaining 4275 articles screened for eligibility, 151 eligible articles were included in the qualitative synthesis after exclusions for the following reasons: main objective unrelated to surgery (n = 1554), case report design (891), not related to soft tissue or oncologic procedures (752), studied species other than dog or cat (328), did not involve live client-owned animals (326), review articles (245), and article full text not available (28).

The 151 articles included data for 10 522 client-owned dogs and cats, with a median study size of 26 (interquartile range, 11–60) animals. Articles were evenly distributed over the study period with 39 (25.8%) published in each of 2013 and 2014, 33 (21.9%) in 2015, and 40 (26.5%) in 2016. Most common publishing journals were *Veterinary Surgery* (44/151 [29.1%]), *Journal of the American Veterinary Medical Association* (35/151 [23.2%]), *Journal of Small Animal Practice* (15/151 [9.9%]), and *Journal of the American Animal Hospital Association* (14/151 [9.3%]); 26 different journals were represented overall. Dogs alone and cats alone were studied in 115 (76.2%) and 19 (12.6%) articles, respectively, and 17 (11.3%) articles included both dogs and cats. Study designs were case series (98 [64.9%]), cohort (41 [27.2%]), controlled trial (11 [7.3%]), and cross-sectional (1 [0.5%]). Data collection was retrospective in 120 (79.5%) and prospective in 31 (20.5%) articles. Articles described prophylactic and therapeutic surgical interventions for 68 different underlying conditions. Traditional open surgical techniques were used in 108 (71.5%) articles, and minimally invasive techniques were used in 43 (28.5%).

The term *complication* was explicitly defined in 11 (7.3%) articles and was not defined in the remaining 140 (93.7%); the term *adverse event* was not defined in any article. Among articles that defined the term *complication*, four articles considered a complication to have occurred if any of a specific list of events was reported in the medical record. The remaining seven articles provided broader definitions, including two previously published definitions (see Supporting Information).

Complications were characterized according to time frame in 96 (63.6%) articles. Terms used to characterize the time frame of complications included *postoperative* ( $n = 76$ ), *intraoperative* (48), *short term* (20), *long term* (18), *perioperative* (16), *immediate* (4), *early* (4), *late* (3), *acute* (2), *chronic* (2), *transient* (1), *permanent* (1), and *delayed* (1); terms were often combined (eg, *immediate postoperative*). Thirty articles used a single time term to classify complications, 41 used two different terms, 18 used three different terms, five used four different terms, and two used five different terms. Among the 96 articles that characterized complications with time frame terms, 65 (67.7%) did not provide a definition for any time term used. The remaining 31 (32.3%) articles defined at least one time term. Definitions provided for commonly used terms varied across studies (Table 1), and 49 of 58 (85.5%) defined time frames fell entirely within or included part of the period between surgical operation and the subsequent 30 days. No study cited the Cook criteria<sup>2</sup> or any other published criteria for time frame reporting.

Complications were characterized according to severity in 60 of 151 (39.7%) articles. The most prevalent scheme used to characterize severity was to describe complications as “major” (10 [6.6%]), “minor” (10 [6.6%]) or both (20 [12.2%]). The criteria according to which complications were judged to be major or minor were reported in 25 of the 40 articles in which

these terms were used and included 19 and 15 different definitions of major and minor, respectively (Supporting Information). No article provided a citation for the criteria used. Twenty-four articles, including four that also used the terms *major* or *minor*, characterized severity using other terms: *mild*, *minimal*, *moderate*, *serious*, *severe*, *significant*, *small*, and *trivial*. The criteria according to which the terms were applied were not reported in any article. Two articles that used other severity terms also classified some complications by using ad hoc numerical grading scales. One article cited a complication grading scheme from human surgery.<sup>5</sup> One article cited a disease-specific numerical grading scale that had been described in a prior veterinary publication.<sup>11</sup> No article classified complications according to the VCOG-CTCAE<sup>9</sup> or Cook criteria.<sup>2</sup>

At least one specific complication was explicitly defined in 32 of 151 [21.2%] articles. Four (2.7%) articles defined surgical site infection, and all provided a citation for the definition, although three different sources were cited among the four articles. Seven (4.6%) articles defined a grading scheme according to which at least one specific complication was classified, including three articles that provided citations for the grading scheme.

Complications were reported in the results of 127 of 151 (84.1%) articles; among the remaining articles, 12 (8%) did not mention complications at all, and 12 (8%) stated that no complications occurred. One hundred forty-four different types of complications were reported, among which 101 (70.1%) were reported in multiple articles. The most commonly reported complications were hemorrhage/bleeding (53 [35.1%]), surgical site infection/inflammation (SSI; 33 [21.9%]), iatrogenic tissue laceration or perforation (28 [18.5%]), aspiration pneumonia (21 [13.9%]), death or euthanasia (21 [13.9%]), seroma (19 [12.6%]), hypotension (18 [11.9%]), nonenteric surgical wound dehiscence (18 [11.9%]), cardiac arrhythmias (15 [9.9%]), cardiopulmonary arrest (15 [9.9%]), respiratory distress (14 [9.3%]), vomiting (13 [8.6%]), conversion from laparoscopy or thoracoscopy to open surgery (12 [7.9%]), diarrhea (11 [7.3%]), regurgitation (11 [7.3%]), equipment failure or technical difficulties (11 [7.3%]), implant failure (10 [6.6%]), sepsis including septic peritonitis (10 [6.6%]), stricture or stenosis (9 [6.0%]), thromboembolism (9 [6.0%]), urinary tract infection (9 [6.0%]), anemia (8 [5.3%]), azotemia (8 [5.3%]), fever or hyperthermia (8 [5.3%]), anorexia (8 [5.3%]), and pneumothorax (8 [5.3%]). Among the 144 different complications reported, 83 (57.6%) were explicitly defined and graded in the VCOG-CTCAE version 1.1. A complete list of reported complications is provided in the Supporting Information with notations regarding whether each is cataloged in the VCOG-CTCAE.

## 4 | DISCUSSION

Most articles reviewed in this study documented complications of surgical treatment and categorized at least one

**TABLE 1** Definitions of terms commonly used to classify the time frame of complications provided in clinical research articles of surgical interventions in dogs and cats

Term	Definition	No. of articles
Intraoperative	During surgery	2
	During anesthesia	2
	Not postoperative	1
	Recorded at the time of surgery	1
Perioperative	During anesthesia	2
	Time from hospital admission until discharge or death	2
	During hospitalization	1
	Time from induction of anesthesia until discharge	1
	During surgery or at extubation	1
	<7 days	1
	<14 days	1
Postoperative	Not intraoperative	2
	Not perioperative	2
	Within 2 weeks of surgery	2
	After recovery from general anesthesia	1
	Within 72 hours of surgery	1
	<1 week	1
	Within 10 days of surgery	1
	Directly related to the surgical procedure	1
	Within the same hospital stay as the surgical procedure	1
	Related to surgery and occurring after surgery until suture removal	1
Short term	≤2 weeks after the procedure	3
	7–30 days	3
	Within 30 days after surgery	2
	During the hospitalization period	1
	10–14 days postsurgery	1
	14–30 days after the procedure	1
	≥2 weeks	1
	≤15 postoperative days	1
	<4 weeks after surgery	1
	Occurring at or before suture removal	1
	Between surgery and the 2-week recheck	1
	Long term	>30 days after the procedure
>2 weeks after the procedure		2
Noted among those with follow-up		1
From surgery until death or last date of contact		1
After discharge from the hospital		1
>15 postoperative days		1
>4 weeks		1
Occurring after suture removal		1

complication according to time frame, severity, or both. However, definitions and criteria used to categorize complications were inconsistently reported and often contradictory between publications. The general lack of detailed reporting and failure to use standardized criteria suggests that complications were treated as ancillary qualitative information rather than as research outcomes and that authors could be unaware of published reporting guidelines and classification systems relevant to reporting complications in veterinary surgery. While complications and other AE are often secondary research outcomes, it is still important to communicate clearly what is meant by various terms and to report events in sufficient detail for readers to judge the impact of potential harms vs benefits.<sup>1,3,5</sup>

It can be difficult to determine whether a given AE is related to surgery, anesthesia, underlying disease, or other factors. Investigators should clearly convey what types of events were included or excluded from harms analyses and how they were selected, as recommended by the CONSORT (Consolidated Standards for Reporting Trials) Statement for Harms reporting guidelines.<sup>1</sup> For example, adopting a relatively narrow definition of complications (eg, including only those of a certain type, severity, or relationship to surgery) will likely result in reporting fewer harms relative to what might be identified from the same exact patients were a broader definition used (eg, including all AE regardless of type, severity, or relationship to surgery). These choices could exert substantial influence on conclusions about a procedure's relative safety or harmfulness. The balance of harms vs benefits for a given surgical treatment will necessarily differ, depending on the health of the study population, the severity of the harms, the magnitude of the benefits, and the availability of alternative treatments. Rare or minor complications carry greater weight in healthy individuals undergoing elective procedures or when a procedure is of limited benefit; for populations with severe disease or procedures with large treatment effects, life-threatening complications might be the only ones that matter in the balance of harms vs benefits.<sup>1</sup> We encourage investigators to report all unfavorable and unintended events temporally associated with surgery in the study results and to use the article discussion section to put harms results in their proper context rather than selectively reporting a subset of interesting or impactful harms. Events directly attributed to surgery can be classified as complications and reported separately from other AE along with the criteria used to distinguish the two types of events. Adoption of standard definitions for the terms *adverse event* and *surgical complication* could help clarify different harms experienced by study animals, as proposed in Table 2. Presenting comprehensive harms data provides an inclusive depiction of patient morbidity, facilitates comparisons between studies and treatment approaches,

ameliorates potential biases associated with selective attribution and reporting, and captures important aspects of patient experience that might not be apparent if only operative complications are documented.

We found that most articles focused on reporting complications that occurred during surgery or within a month or less after surgery. This is a substantially shorter interval compared with the time period considered relevant for harms reporting in veterinary orthopedic research<sup>3</sup> and could explain why the Cook criteria were not cited in this set of soft tissue articles. We propose that authors record complications and other AE associated with the three main time periods defined in Table 2, preoperative, intraoperative, and postoperative. The surgical operation is a well-defined time period that serves as a natural and relevant anchor point around which to delineate other events. The preoperative designation can be used to report AE that occur after the initiation of anesthesia but prior to commencement of surgery. The postoperative period could be further subdivided (eg, in hospital, short term, long term) on the basis of the follow-up interval considered relevant for a given procedure, disease, or study design, as long as subperiods are clearly defined in study methodologies. We recommend that investigators survey for and report AE that develop up to 30 days after surgery or explain why this was not done whenever possible. Studies that survey for complications only during the hospitalization period or other truncated intervals could reasonably fail to identify adverse outcomes that are not immediately apparent or distinguishable from the routine postoperative course. The term *perioperative* was applied in a particularly ambiguous and variable manner in the articles in this review; therefore, we discourage its use for AE reporting. Adoption of the proposed definitions for the

**TABLE 2** Proposed terminology for defining adverse events, complications, and major reporting time frames in clinical studies of small animal soft tissue and oncologic surgery

**Adverse event:** Any unfavorable and unintended incident, sign, or disease temporally associated with the use of a medical treatment that may or may not be attributed to the treatment

**Surgical complication:** An adverse event temporally associated with and attributed to surgical intervention

**Preoperative:** Time period prior to skin incision (or equivalent in procedures involving open traumatic or surgically created wounds)

**Intraoperative:** Time period from skin incision to skin closure (or equivalent in procedures involving open traumatic or surgically created wounds)

**Postoperative:** Time period after skin closure (or equivalent in procedures involving open traumatic or surgically created wounds)

intraoperative and postoperative periods should cause minimal burden on investigators because the criteria are intuitive and correspond with definitions and intervals already in common use.

Many complications and AE manifest across a wide spectrum of severity that ranges from subclinical to life threatening; simply reporting that a given complication occurred can provide minimal information about the actual harm (or lack thereof) it caused to patients. The Clavien-Dindo grading system<sup>5</sup> and its most recent iteration, the Accordion Severity Grading System,<sup>6</sup> are human therapy-based classifications developed for grading postoperative complications and appear to have broad potential applicability to grading postoperative complications in veterinary surgery (Table 3). Therapy-based complication grading schemes are considered particularly useful tools for identifying complications and preventing downrating of serious negative outcomes in retrospective analyses<sup>5</sup> that account for most veterinary soft tissue and oncologic clinical studies. Another approach to AE grading is the VCOG-CTCAE,<sup>9</sup> a standardized grading scheme that provides definitions and specific grading criteria for over 200 individual events. Compared to the Accordion classification, the more detailed CTCAE approach has the potential advantages of standardizing event definitions and reducing the extent to which investigators are required to make subjective judgments. Some of the VCOG-CTCAE grading criteria are therapy based but are constructed around what therapy is indicated rather than what therapy was administered. This could be more relevant for veterinary medicine compared with the human therapy-based schemes

because some pet owners decide not to provide additional or optimal therapy because of emotional or financial limitations. The main shortfall of the current VCOG-CTCAE is that it catalogs only a limited number of events and does not include a number of relevant surgery-related events. Nevertheless, most reported complications in this set of articles, and in particular those that occurred during the preoperative and postoperative periods as defined in Table 2, could have been graded by using the VCOG-CTCAE. Expansion of the VCOG-CTCAE with additional events relating to surgery could extend its applicability and relevance beyond the field of medical oncology. The CTCAE method could be particularly favorable for studies relating to surgical oncology because the VCOG-CTCAE is widely used to categorize harms associated with oncologic therapies administered as complementary or alternative approaches to surgery.<sup>10</sup>

A principal limitation of both the existing CTCAE and the Accordion classification is the inability to account for intraoperative events. We propose definitions and grading criteria for three commonly reported intraoperative events based on reporting in human surgery<sup>7,8,12</sup> and presented in the style of the CTCAE (Table 4). Intraoperative complications of all kinds could alternatively be graded by using a wide-ranging scheme developed for use in human surgery, the Classification of Intraoperative Complications (CLASSIC; Table 5).<sup>7</sup> The CLASSIC system is similar to the Accordion classification in terms of providing broad semisubjective categories that must be applied and adjudicated by investigators. Reporting and classification of intraoperative events is challenging because the majority of unfavorable intraoperative incidents pass unrecognized or are not recorded in medical records.<sup>8</sup> Intraoperative complications without postoperative adverse consequences to patients could nevertheless have important implications for refining surgical strategies and techniques.<sup>8</sup> Because of the preponderance of retrospective surgical studies, clinical investigators could consider asking principal surgeons at their institutions to judge and record a CLASSIC grade at the end of each operation.<sup>7</sup> This step could be incorporated into postoperative surgical safety checklist procedures.

Surgical site infection/inflammation was the second most commonly reported complication in this set of articles and is a potential postoperative complication for any surgical intervention. Documentation and treatment of veterinary SSI is an emerging public health issue because of growing concern about antibiotic resistance.<sup>13</sup> Studies designed to measure and reduce rates of SSI in dogs and cats cannot be meaningfully interpreted unless consistent definitions and terminology are used. Investigators are encouraged to use established definitions<sup>14</sup> to identify SSI, and they can use general-use grading schemes such as those previously discussed to classify severity. Because of the prevalence and importance of

**TABLE 3** The Accordion Severity Classification of Postoperative Complications: Contracted Classification<sup>a</sup>

Level	Definition
1	Mild complication: Requires only minor invasive procedures that can be performed at bedside such as insertion of intravenous lines, urinary catheters, nasogastric tubes, and drainage of wound infections. Physiotherapy and the following drugs are allowed: antiemetics, antipyretics, analgesics, diuretics, and electrolytes
2	Moderate complication: Requires pharmacologic treatment with drugs other than those allowed for minor complications (eg, antibiotics); blood transfusions and total parenteral nutrition are also included
3	Severe complication: All complications requiring endoscopic or interventional radiologic procedures or reoperation as well as complications resulting in failure of one or more organ systems
4	Death: Postoperative death

<sup>a</sup>An expanded classification in the area of “severe” complications is available and recommended for large studies of very complex procedures.<sup>6</sup>

**TABLE 4** Proposed definitions and grading of three commonly reported intraoperative complications

Intraoperative incidents					
Adverse event	Grade				
	1	2	3	4	5
Iatrogenic tissue injury <sup>a</sup>	Incidents managed with minimal change in operative tactics and without further consequences for the patient	Incidents managed with change in operative tactics but without further consequences for the patient	Incidents with further non-life-threatening consequences for the patient	Incidents with further life-threatening consequences for the patient	Incidents resulting in death
Technical failure <sup>b</sup>	Incidents managed with minimal change in operative tactics and without further consequences for the patient	Incidents managed with changes in operative tactics but without further consequences for the patient	Incidents with further non-life-threatening consequences for the patient	Incidents with further life-threatening consequences for the patient	Incidents resulting in death
Conversion from laparoscopic or thoracoscopic approach <sup>c</sup>	Strategic conversion to hand-assisted or open approach due to anticipated operative difficulty	Reactive extension of an incision or conversion to hand-assisted approach because of operative difficulty or non-life-threatening operative error	Reactive conversion to open approach because of operative difficulty or non-life-threatening operative error	Reactive conversion to open approach due to life-threatening operative error	...

Abbreviation: .... Grade 5 severity is not defined for the complication of operative conversion. If an animal died as a result of an event that required conversion, the conversion would be grade 4 and the underlying event would be the cause of death.

<sup>a</sup>Injury to tissues adherent or adjacent to the intended operative site.

<sup>b</sup>Malfunction of operative equipment, instruments, or implantable materials, whether due to operator error or not.

<sup>c</sup>Intraoperative switch from laparoscopic or thoracoscopic approach to hand-assisted or open laparotomy or thoracotomy. A strategic conversion is made directly after feasibility assessment of completing the operation with the intended technique because of anticipated operative difficulty or logistic considerations. A reactive conversion is made in response to an operative error or operative difficulty after intracorporeal procedures or dissection have begun.<sup>12</sup>

**TABLE 5** Classification of Intraoperative Complications (CLASSIC) criteria<sup>a</sup>

Grade	Definition
0	No deviation from the ideal operative course
I	Any deviation from the ideal operative course Without the need for any additional treatment or intervention
II	Any deviation from the ideal operative course With the need for any additional treatment or intervention Not life threatening and not leading to permanent disability
III	Any deviation from the ideal operative course With the need for any additional treatment or intervention Life threatening and/or leading to permanent disability
IV	Any deviation from the ideal operative course With the death of the patient

<sup>a</sup>Sequelae, failures of cure, events related to underlying disease, wrong-site or wrong-patient surgery, and errors in indication are not defined as intraoperative complications.<sup>7</sup>

SSI as a harms outcome, a more specific and standardized set of guidelines for defining and grading SSI could be warranted to truly standardize reporting in veterinary medicine.

In addition to the adoption of proposed standard definitions and use of published schemes to classify events, investigators should attempt to quantitate complications and other AE whenever possible rather than relying on narrative synthesis alone.<sup>1</sup> Tables can be useful to present numeric harms data including frequencies, types, and grades of events and numbers of animals with information available for analysis (ie, denominators, Table 6).<sup>6</sup> Authors should distinguish between animals that had one vs those that had multiple events when it is pertinent and should specify whether recurrent events are counted as single or separate events.<sup>1</sup>

This study has several limitations. There is potential for selection bias based on whether relevant articles were recognized by our search terms at the search level. We have previously demonstrated that medical database searches do not necessarily identify all relevant veterinary publications,<sup>15</sup> although we undertook a broad search involving databases reported to have maximum veterinary journal coverage.<sup>16</sup>



**TABLE 6** Sample table for reporting postoperative complications<sup>a</sup>

Complications	Patients assessed for complications	
	Group 1, N = 100, n (%)	Group 2, N = 50, n (%)
Grade 1		
Vomiting	9 (9)	5 (10)
Diarrhea	11 (11)	5 (10)
Seroma	4 (4)	2 (4)
Fever	1 (1)	2 (4)
Total grade 1 complications	25 (25)	14 (28)
Grade 2		
Vomiting	4 (4)	1 (2)
Laryngeal edema	0 (0)	1 (2)
Total grade 2 complications	4 (4)	2 (4)
Grade 3		
Esophagitis	1 (1)	0 (0)
Total grade 3 complications	1 (1)	0 (0)
Grade 4		
Acute kidney injury	0 (0)	1 (2)
Septic peritonitis	5 (5)	5 (10)
Total grade 4 complications	5 (5)	6 (12)
Grade 5		
Death due to septic peritonitis	2 (2)	2 (4)
Total grade 5 complications	2 (2)	2 (4)

<sup>a</sup>Adapted from Strasberg et al.<sup>6</sup>

The publication years searched were based on convenience sampling and were the most recent complete publication years at the time of study initiation. We consider these 151 articles an adequate representation of current reporting practices because of the broad search and variety of journals and disease conditions included. Limitations at the study level included potential for publication or editorial biases that affected which articles were published or what information was included in articles. Most articles involved retrospective identification of harms, which could bias the number, type, and severity of harms reported. Limitations at the review level included potential for selection bias in identifying publications and misclassification bias during data abstraction. Recommendations for future reporting are based on the authors' interpretation of study data in combination

with definitions and guidelines developed for reporting human and nonsurgical veterinary data and therefore could require additional adaptation to achieve relevance and validity for veterinary soft tissue surgical research reports.

There is substantial room to improve and systematize harms reporting in clinical studies evaluating soft tissue and oncologic surgical procedures in dogs and cats. Adoption of standardized definitions and grading schemes could result in more complete, transparent, and understandable reporting of veterinary surgical complications.

## CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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