
Cornel IGNA*1, Daniel BUMB1, Bogdan SICOE1, Larisa SCHUSZLER1, Cristian ZHA1

1 Banat’s University of Agricultural Sciences and Veterinary Medicine “King Michael I of Romania” from Timișoara, Romania, Timișoara, Calea Aradului, no 119, postal code 300645
‘corresponding author: ignacornel@gmail.com

Abstract:
Surgical site infections (SSIs) remain an important concern in veterinary practice. The purpose of this work was to determine the SSIs rate in the Surgery Clinic of the Faculty of Veterinary Medicine, Timișoara and to correlate SSIs incidence with surgical wound classification by degree of contamination and with the use of antimicrobial prophylaxis and / or applied therapy. Records of all animals operated on between 2007 and 2017 were closely checked for development of postoperative wound infection and were reviewed. The rate of surgical site infection was 0.77%, and by categories was 0.70% in clean surgeries, 0.15% in clean-contaminated surgeries, 1.76% in contaminated surgeries, and 1.08% in infected surgeries.

Baseline information for SSIs surveillance in our surgical clinic and for comparison with other studies was defined. SSIs frequency in companion animals in our service is comparable with the frequency observed in another studies.

Keywords: cat, dogs, surgical site infections

Introduction
Surgical site infections (SSIs) remain an important concern in veterinary practice. SSIs represent a significant source of morbidity, mortality, and cost associated with small animal surgery (Nelson, 2011). In USA, Centers for Disease Control and Prevention (CDC) have developed standard criteria for defining SSIs (Horan et al., 1992). These classify SSIs into superficial incisional, deep incisional and organ/space SSI (Table 1).

The classification of operative wounds, developed by the National Research Council is shown in table 2.

At this moment, the primary source of infections in surgery rooms is not known and neither the manner in which they are associated with the postoperative infectious complications (Andrade et al., 2014). Little objective information is available to validate the way in which asepsy / antisepsy and surgery techniques can control the intraoperative contamination (Andrade et al., 2014). Identifying the source for SSI in surgical services can allow development of control strategies based on evidence. For this purpose we have proposed to determine the SSI rate in the Surgery Clinic of the Faculty of Veterinary Medicine, Timișoara (FVTM) and to correlate SSI incidence with surgical wound classification by degree of contamination and with the use of antimicrobial prophylaxis and / or applied antimicrobial therapy.

Materials and methods
Records of companion animals (dogs and cats) operated on between 2007 and 2017 were
retrospectively monitored for development of postoperative wound infection and were reviewed. Patients were examined for clinical evidence of SSI at suture removal.

Retrospective data included species, surgical procedures / wound classification (clean, clean-contaminated, contaminated and dirty) and the presence of an active infection (superficial incisional, deep incisional and organ / space), administration of antibiotics, and the type of antibiotics used.

**Results and discussions**

Out of the 12581 cases operated on between 2007 and 2017, 8683 have met the criteria to be included in this study. Excluded cases were due to the fact that records were incomplete or the owners could have not returned to our clinic. The incidence of surgical site infection was 0.77%. The incidence of postoperative infections according to surgical procedures / wound classification is shown in Table 3.

Distribution by categories of surgical site infections is shown in table 4.

Most of SSIs from the clean and clean-contaminated wounds categories (33 out of 36) were superficially located, positively responding to antibiotic administration and / or conventional wound localized therapy. Of 4861 interventions considered clean, 3948 (81.2%) did not receive prophylactic antibiotics.

For the contaminated (626 interventions) and dirty categories (1855 interventions) all of the cases have benefited from prophylactic and postoperative antibiotic therapy, having an infection rate of 1.76% (11 cases) and 1.08% (20 cases). The most frequently used antimicrobial prophylaxis was amoxicillin in association with clavulanic acid, followed by ampicillin, cefazolin, sulbactan and enrofloxacin. Antimicrobial treatment for dirty category followed in 2% of cases (38 patients) the indications of culture and antibiogram tests.

Most cases (10 out of 12) with SSI organ / space have come from orthopedic interventions, osteosynthesis with metallic implants, in open fractures. It is recognized that the use of implants significantly increases the risk of SSI (Shales, 2012; Turk et al., 2015).

Information in the veterinary literature regarding the frequency of wound infection in surgical small animal patients is limited. Classification of the surgical interventions by the degree of contamination has been reported to be associated with SSI frequency in veterinary surgery (Eugster et al., 2004; Vasseur et al. 1988;
Weese, 2008), although one study questioned its usefulness in small animals (Brown et al., 1997).

In the veterinary literature, data on SSI rates of 5 to 6% have been reported, with lower rates of 2% for clean procedures and higher rates of up to 18% for contaminated or dirty procedures (Vasseur et al. 1988; Brown et al. 1997; Beal et al. 2000; Nicholson et al. 2002; Eugster et al. 2004; Frey et al., 2010; Mayhew et al., 2012; Arias et al., 2013).

In cases of the dirty surgical interventions, we believe that vigorous debridement, insistent and repeated lavage of operative wounds along with prophylactic and curative antibiotic therapy can significantly contribute to reducing the number of SSIs.

Preoperative use of antibiotics may reduce the incidence of postoperative surgical site infections (Whittem et al.; 1999; Weese, 2006, 2008; Frey et al., 2010), but if the risk of infection is low, the inappropriate use of antibacterials is likely to lead the unnecessary costs for the owner and may increase the risk of antibacterial resistance and suprainfection (Dohmen, 2008; Page, 2017). In veterinary studies, the postoperative use of antimicrobials has shown to increase the risk of

Table 2. National Research Council risk index for surgical infections (from Wesse, 2008)

<table>
<thead>
<tr>
<th>Surgical wound classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean</td>
<td>Non-traumatic elective procedure. No entry into gastrointestinal, urogenital or respiratory tract. No break in aseptic technique (e.g. elective uncomplicated cutaneous mass removal).</td>
</tr>
<tr>
<td>Clean-contaminated</td>
<td>Entry into a hollow viscus with no significant spillage (e.g. cystotomy, ovariohysterectomy) and no infection present (e.g. cystitis, cholecystitis); or a clean procedure following a minor break in aseptic technique.</td>
</tr>
<tr>
<td>Contaminated</td>
<td>Fresh (&lt;6-8 hours old) traumatic wounds. Spillage from a contaminated viscus during surgery. Entry into a hollow viscus in the presence of infection (e.g. cystitis, cholecystitis). Clean surgery following a major break in aseptic technique.</td>
</tr>
<tr>
<td>Dirty</td>
<td>Infected surgical site (bacteria multiplying within tissue). Purulent discharge encountered. Wound open and untreated for &gt;6-8 hours.</td>
</tr>
</tbody>
</table>

Table 3. Incidence of SSIs dependent on surgical procedure / wound classification

<table>
<thead>
<tr>
<th>Surgical wound classification</th>
<th>Number of interventions</th>
<th>SSIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean</td>
<td>4861</td>
<td>34</td>
</tr>
<tr>
<td>Clean-contaminated</td>
<td>1341</td>
<td>11</td>
</tr>
<tr>
<td>Contaminated</td>
<td>626</td>
<td>20</td>
</tr>
<tr>
<td>Dirty</td>
<td>1855</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 4. Incidence of SSIs categories

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Superficial incisional SSI</th>
<th>Deep incisional SSI</th>
<th>Organ / space SSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>61</td>
<td>38</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>%</td>
<td>100</td>
<td>62.3</td>
<td>18.0</td>
<td>19.7</td>
</tr>
</tbody>
</table>
SSIs in clean surgeries (Brown et al., 1997; Eugster et al., 2004).

This paper is the first study in Romania that describes the incidence of SSIs dependent on surgical procedure / wound degree of contamination (as described by Wesse, 2008) and classifies SSIs by depth of the procedure (as described by Horan et al., 1992), and therefore it has a series of limitations: data collection was conducted quantitatively, as number of cases, number of treated cases and number of surgical site infections, and not as categorical lists, which restricts the possibilities of statistical analysis tools and, as such, no t tests, ANOVA or regression analyses could be done. The only category of tests that this kind of data collection allows are χ² tests, which were performed and yielded p values of less than 0.05 for all findings in our study, relegating them as statistically significant; the data collection of SSI cases for surgical sites classified as „clean” or „clean-contaminated” was done irrespective of data collection of cases for which pre-operative or post-operative antimicrobial prophylaxis was prescribed. Thus, no correlations can be drawn as to the influence of antimicrobial prophylaxis on the incidence of SSIs for these types of surgical sites; all cases with surgical sites classified as “contaminated”or “dirty” were prescribed post-operative prophylactic antimicrobials and, as such, no conclusions can be drawn as to the efficiency of post-operative antimicrobial administration for these types of surgical sites.

Baseline information for SSIs surveillance in our surgery clinic and for comparison with other studies was defined. SSIs frequency in companion animals in our service is comparable with the frequency observed in another studies.

Further studies should take into consideration the above-mentioned factors in relation to surgical site infection development order to be able to draw any significant conclusions regarding their correlation to SSIs.

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References