Eurasian Journal
of Veterinary Sciences

www.eurasianjvetsci.org

RESEARCH ARTICLE

Evaluation of bacterial translocation in cats undergoing laparotomy

Kurtulus Parlak[1*], Semih Altan[2], Simten Yesilmen Alp[3], Eyup Tolga Akyol[1], Elgin Orcum Uzunlu[1]
Nuriza Zamirbekova[1], Fahrettin Alkan[1]

[1]Selcuk University, Veterinary Faculty, Department of Surgery, Konya, Turkey
[2]Dicle University, Veterinary Faculty, Department of Surgery, Diyarbakır, Turkey
[3]Dicle University, Veterinary Faculty, Department of Microbiology, Diyarbakır, Turkey

Received:05.05.2022, Accepted: 09.08.2022
*kparlak@selcuk.edu.tr

Laparotomi yapılan kedilerde bakteriyel translokasyonun değerlendirilmesi

Eurasian J Vet Sci, 2022, 38, 3, 168-172
DOI: 10.15312/EurasianJVetSci.2022.379

Öz

Amaç: Kedilerde intraabdominal basıncı arttırdığı düşünülen ya da bağırsak duvarına basınç yapan patolojilere yönelik laparotomi uygulamalarında bakteriyel translokasyonun (BT) varlığının değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Selçuk Üniversitesi Hayvan Hastanesine getirilen, klinik, laboratuar, ultrasonografik ve radyografik muayene sonucu laparotomi kararı alınan 25 kedi değerlendirildi. Operasyon esnasında abdominal bölgeye girildikten hemen sonra periton sıvısından ve uygun olan bir mezenteriyel lenf nodülünden (MLN) steril swap ile sürüntü örnekleri alındı. Bakteriyel suşların tanımlanması gerçekleştirildi ve oluşan bakteriyel spektrumlar analiz edildi. Bakteriyel suşların antibiyotik direnci Kirby-Bauer disk difüzyon metodu ile belirlendi.

Bulgular: 25 kedinin 4'ünde (%16) yabancı cisim nedeniyle bağırsak perfüzyonunun bozulmasına bağlı BT saptandı. BT'nin 2'si sadece MLN'den 2'si ise hem periton boşluğu hem de MLN'den alınan swab örneklerinden izole olduğu belirlendi. Peritonda üreyen bakterilerin %50'sini E. faecalis (n=2), %50'sini ise E. faecium (n=2) oluşturduğu belirlenirken lenf yumrusundan alınan örneklerde P. fluorescens ve E. faecalis bakterilerinin ürediği belirlendi.

Öneri: İntraabdominal basıncı ya da bağırsak duvarını etkileyen patolojilerin varlığında akla BT gelmelidir. Özellikle bağırsak duvarına doğrudan etki eden (yabancı cisim, konstipasyon, obstipasyon vb.) patolojilerde BT şüphesinin daha da artması gerektiği düşünülmektedir. Antibiyogram yapılarak spesifik antibiyotik kullanımının prognoz açısından daha olumlu olacağı düşünülmektedir.

Anahtar kelimeler: Kedi, bakteriyel translokasyon, laparatomi, peritonitis

Abstract

Aim: This study aimed to evaluate the presence of bacterial translocation (BT) in cats undergoing laparotomy procedures for pathologies that are thought to increase intra-abdominal pressure or pressurize the intestinal wall.

Materials and Methods: Twenty-five cats were evaluated that refered to Selcuk University Animal Hospital for laparotomy after the clinical, laboratory, ultrasonographic and radiographic examinations. Sterile swab samples were taken from the peritoneal fluid and an appropriate mesenteric lymph nodes (MLN) immediately after reaching the abdominal region during the laparatomy. Identification of bacterial strains was carried out and bacterial spectra were analyzed. Antibiotic resistance of bacterial strains was determined by the Kirby-Bauer disc diffusion method.

Results: BT was diagnosed in 4 (16%) of 25 cats as a result of deteriorated intestinal perfusion due to foreign body. It was determined that 2 of the BT were isolated from swap samples taken from only MLNs and 2 of them were isolated from swap samples taken from both the peritoneal cavity and MLNs. It was determined that 50% of the bacteria growing in the peritoneum were E. faecalis (n=2) and 50% were E. faecium. It was determined that the bacteria growing in the MLNs formed P. fluorescens and E. faecalis.

Conclusion: BT should be considered in the presence of pathologies that affect intra-abdominal pressure or affect the intestinal wall. It is thought that the suspicion of bacterial translocation should increase in pathologies that directly affect the intestinal wall. It is thought that the use of specific antibiotics will be more positive in terms of prognosis by performing an antibiogram.

Keywords: Cat, bacterial translocation, laparatomy, peritonitis

Introduction

Bacterial translocation (BT) is a process that occurs as a result of various etiological factors. It is defined as the passage of bacteria normally found in the intestinal lumen through the stable intestinal wall and then the portal and systemic transport of these bacteria to the mesenteric lymph nodes (MLN) (Berg 1999, Güngör et al 2003). The gut microbiota is normally in a state of homeostasis. However, this homeostasis may be impaired due to various etiological factors. Then, especially gram (-) bacteria and their endotoxins, and gram (+) bacteria can pass into the portal, systemic and lymphatic circulation through the intact intestinal wall. Translocated bacteria can be found in abdominal organs such as spleen, liver, kidney and peritoneum, especially in the MLN. A high rate of BT to regional MLNs occurs due to the deterioration of intestinal perfusion with an increase in intra-abdominal pressure. This is thought to be an important cause of development of infection and can lead to sepsis in patients with increased intra-abdominal pressure. Since BT is mostly seen in MLNs, microbiological culture results from these organs can give a valuable idea about the organisms that responsible for sepsis (Altan et al 2018, Altan et al 2019).
This study aimed to evaluate the presence of BT in cats undergoing laparotomy procedure in the presence of pathologies that increase intra-abdominal pressure or intestinal wall pressure (megacolon, urolithiasis, splenomegaly, gastrointestinal foreign bodies, hepatomegaly, hydronephrosis, hernia diaphragmatica, intra-abdominal neoplasmic masses, etc.).

Material and Methods

Twenty-five cats were evaluated that refered to Selcuk University Animal Hospital for laparotomy after the clinical, laboratory, ultrasonographic and radiographic examinations. Primary inclusion criteria for the cats were not receive any antibiotic therapy for last 2 weeks.

Anesthesia and surgical procedures

Medetomidine HCl (Domitor®; 0,025 mg/kg, IM) and butarphanol (Butomidor; 0,1 mg/kg, IM) were administered as pre-anesthetics in cats for laparotomy. Subsequently, anesthesia induction was achieved by administering propofol (Propofol-Lipuro 1%®; 1,5-3 mg/kg, IV). Anesthesia was maintained with isoflurane in oxygen (Isoflurane; 2%) in cats that were intubated with an internal size of 2,5-3 mm cuffed endotracheal tube. Sterile swab samples were taken from the peritoneal fluid and an appropriate MLN immediately after reaching the abdominal region during the laparatomy. For post-operative antibiotic therapy, metronidazole (Polygyl 0,5%; 7,5 mg/kg, q24h, IV) for 3 days and cefazol soidum (Iespor®; 30 mg/kg, q24h, IM) for 7 days were administered. As analgesic, meloxicam (Metacam®) was administered PO route with 0,1 mg/kg on the first day and continued PO route with 0,05mg/kg for the next 4 days.

Microbiological analysis

Swab samples from MLNs and peritoneal fluid were transported in a cold chain box to the Microbiology laboratory immediately for analysis.

Each sample was incubated aerobically at 37ºC for 18-24 hours in 100 µl of buffered peptone water (Merck, 107228, Darmstadt, Germany). 10µl of liquid cultures were passaged on 7% sheep blood agar (Merck, 110886, Darmstadt, Germany), MacConkey agar (Merck, 05465, Darmstadt, Germany) and Eosin Methylen Blue agar (Merck, 01347, Darmstadt, Germany). After the passage they were incubated under aerobic conditions at 37ºC for 24-48 hours (Markey et al 2013). Following incubation, bacterial colonies were purified on nutrient agar (Condalab, 1060, Madrid, Spain). Identification of bacterial strains was carried out in VITEK MS MALDI-TOF (bioMerieux, Marcy l'Etoile, France) device and bacterial spectra were analyzed with VITEK MS database. For mycological isolation, samples were seeded on Sabouraud dextrose agar (Oxoid, CM0041, UK) supplemented with chloramphenicol (0,05 mg/mL) (Oxoid, SR0078, UK) and incubated at 25ºC and 37ºC for 1-4 weeks (Markey et al 2013).

Antimicrobial susceptibility test

The Kirby-Bauer disc diffusion method was used to determine the susceptibility of bacterial strains to different antibiotics. Susceptibility of Gram-possitive and Gram-negative strains to cefotaxime (30µg, Oxoid, UK), cefquinome (30µg, Oxoid, UK), ceftiofur (30µg, Oxoid, UK), cephalothin (30µg, Oxoid, UK), moxifloxacin (5ug, Oxoid, UK), trimethoprim-sulfamethoxazole (1,25/23,75µg, Ooid, UK), chloramphenicol (30ug, Oxoid, UK), danofloxacin (5ug, Oxoid, UK), enrofloxacine (5ug, Oxoid, UK) and tetracycline (30ug, Oxoid, UK) were analyzed. Additionally, susceptibility of Gram-possitive strains to vancomycin (30µg, Oxoid, UK) and susceptibility of Staphylococcus strains to cefoxitin (30µg, Oxoid, UK) were analyzed. Inhibition zone diameters were evaluated according to CLSI. Strains resistant to ≥3 antimicrobial agents were defined as multidrug resistance (MDR) strains (Tenover 2006, Schwarz et al 2010).

Results

The breed distribution was determined as Scottish Fold (n=4), British Shorthair (n=2), Van (n=1), Siamese (n=2)

and mix breed (n=16) in the study. The age range was 14±1 (months). The evaluated population consisted of 11 males and 14 females.

Laparotomy procedure was performed to the cats with the diagnosis of hernia diaphragmatica (n=4), foreign body in the gastrointestinal tract (n=6), megacolon (n=7), splenomegaly (n=1), intestinal invagination (n=1) (Figure 1), rectal prolapse (n=1) (colopexy) and urolithiasis (n=5) (Figure 2).

BT was diagnosed in 4 (16%) of 25 cats. It was determined that 2 of the BT were isolated from swap samples taken from only MLNs and 2 of them were isolated from swap samples taken from both the peritoneal cavity and MLNs. It was determined that 50% of the isolated bacteria in the swab samples from peritoneum were E. faecalis (n=2) and 50% were E. faecium (n=2). Also the bacteria isolated in the swab samples from MLNs were P. fluorescens and E. faecalis.

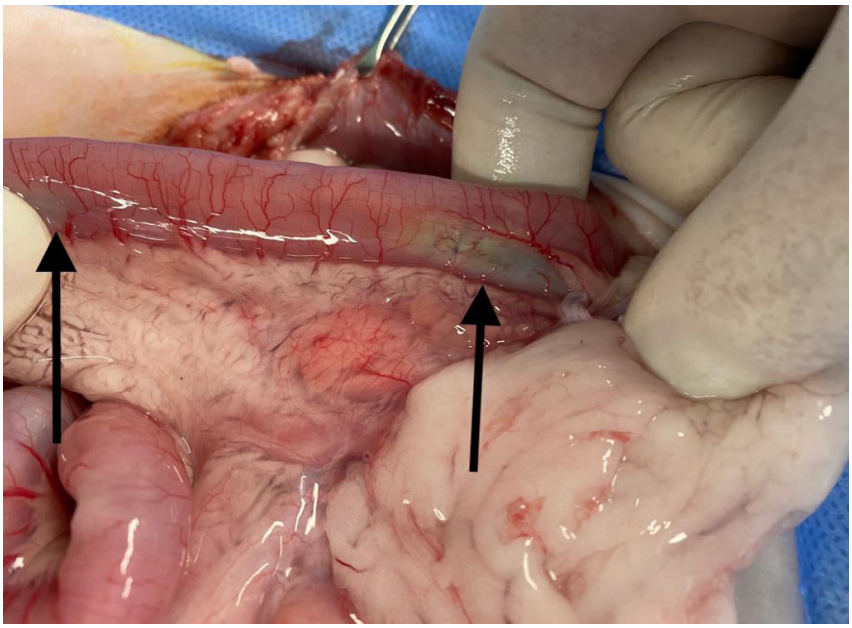

Figure 1. Deterioration of intestinal perfusion due to foreign body in a cat with BT

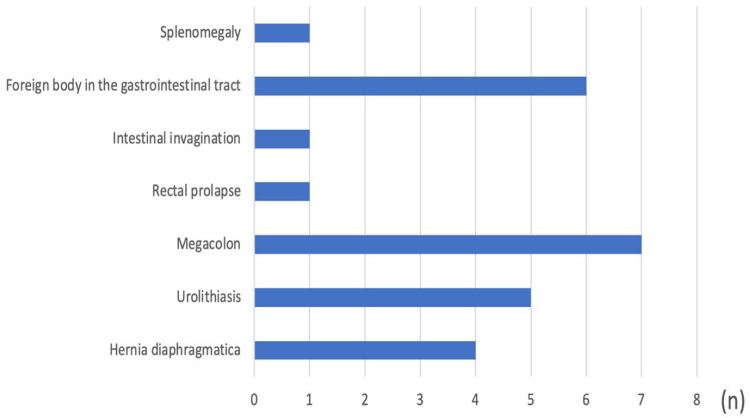

Figure 2. Indications for abdominal surgery in the cats

It was determined that BT due to foreign body in 4 cats. The foreign body was noteworthy as thread in 3 cats. Prognosis was evaluated between cats with BT and without BT. Death was observed on the 3rd postoperative day in 3 of the cats with BT. Blood tests of the cats with BT were showed that lactate levels (mean 3,60 mmol/L) were higher than those without BT (mean 2,5 mmol/L).

Discussion

BT may occur in local MLNs due to decreased intestinal perfusion, which plays an important role in the development of infection and sepsis in patients with increased intra-abdominal pressure (Güngör et al 2003, El-Awady et al 2009). Bacteria can be translocated to abdominal organs such as spleen, liver, kidney and peritoneum, especially to MLNs. Since BT is mostly seen in MLNs, microbiological culture from these organs can give a valuable idea about the organisms that responsible for sepsis (Altan et al 2018, Altan et al 2019). In our study, it was observed that bacteria were more prone to translocate to MLNs than peritoneum in 4 cats. This supports the literature on this subject.

The pathogenesis of intestinal obstruction due to linear foreign body (LFB) involves fixation of the foreign body in a cranial region of the gastrointestinal tract. Usually, LFBs anchor themselves on the base of the tongue or retained in the pylorus. Peristaltic waves continue to move the free end of the foreign body distally in the small intestine, eventually resulting in aggregation (plication) of the intestine around the foreign body. Intestinal fold can be explained by the fact that peristaltic waves cause the intestine and intestinal contents to move in opposite directions. The small intestine forms circular loops due to mesenteric restriction, and the LFB under tension tends to be arranged in a straight line. The mesenteric border becomes hardens and edematous due to the LFB. Perforation of the affected intestinal loops may result in local or generalized peritonitis (Root and Lord 1971, Felts et al 1984). In the study, it was determined that 4 cats had LFB originated BT. Based on the literature, BT may occur due to perforation caused by the LFB in the mesenteric parts of the intestinal wall.

Peritonitis is a common complication of abdominal surgery. There are two major reasons. The first is iatrogenic with manipulation of the abdominal viscera and irritation of the serosa. The second is sepsis. This may occur through disruption of the sterile environment during the operation, perforation of organs (especially intestinal perforation) before the operation, excessive dilatation of the intestines, and translocation of bacteria from the intestinal wall to the peritoneal space (Mulon and Dreschores 2005). In the study, evaluation of the prognosis was made between cats with BT and without BT. Death was observed on the 3rd postoperative day in 3 of the cats with BT. Blood tests of the cats with BT were showed that lactate levels (mean 3,60 mmol/L) were higher than those without BT (mean 2,5 mmol/L). In accordance with the literature data it is thought that manipulation of the abdominal viscera during the operative process, which is an abdominal surgery, may have caused peritonitis or sepsis, and significant changes in lactate levels in this study may have contributed to death.

Many infectious agents are known or suspected causes of gastrointestinal morbidity in kittens. However, bacterial culprits are difficult to decipher as they exist among a large and diverse enteric microbiome. Gram-positive enterococci are an important part of the enteric microbiome and are generally considered to be gastrointestinal commensals. However, several other strains of E. faecium and E. faecalis are recognized as serious potential pathogens. The clinical significance of these enterococcis are largely attributed to their ability to acquire multiple antimicrobial resistance, opportunistically infect tissues outside the gastrointestinal tract, and form flexible environmental biofilms (Costello et al 2004, Wagner et al 2007, Litster et al 2009, Ghosh et al 2012, Hamilton et al 2012, KuKanich et al 2012). Costello et al. (2004) stated that E. coli, Enterococcus spp and Clostridium spp among the most commonly isolated organisms in cats. They also stated that the most common cause of peritonitis was gastrointestinal system leakage. In the 25 cats evaluated in our study, it was determined that 50% of the isolated bacteria in the swab samples from peritoneum were E. faecalis (n=2) from the Enterococcus family and 50% were E. faecium, P. fluorescens and E. faecalis were determined to be caused by bacteria growing in the MLN. In addition, another similarity in the study of Costello et al. (2004) is that gastrointestinal system leakage is the cause of peritonitis. In our study, leakage was observed due to intestinal perforation caused by LFB in cats with BT.

Conclusion

In conclusion, bacterial translocation should be considered in the presence of pathologies that affect intra-abdominal pressure or affect the intestinal wall. According to data we have obtained, it is thought that the suspicion of bacterial translocation should increase in pathologies that directly affect the intestinal wall (such as foreign body, constipation, obstipation). Antibiogram is not very practical in terms of time and money. However broad-spectrum antibiotics can be given under appropriate conditions to take precautions. It is thought that the use of specific antibiotics will be more positive in terms of prognosis by performing an antibiogram if possible.

Conflict of Interest

The authors did not report any conflict of interest or financial support.

Funding

This study was supported by the Scientific Research Projects Coordination Unit, Selcuk University (Project Number: 20401097).

References

Altan S, Koç Y, Alkan F, 2019. Yenidoğan buzağılardaki intestinal cerrahide bakteriyel translokasyonun önemi, In: Ruminantlarda Neonatal Cerrahi, Ed; Baran V, First edition, Türkiye Klinikleri, Ankara, Turkey, pp; 65-8.

Altan S, Koç Y, Alkan F, Sayın Z, et al., 2018. Impact of bacterial translocation in calves with atresia coli. J Vet Emerg Crit Care, 28(3), 261-268.

Berg RD, 1999. Bacterial translocation from the gastrointestinal tract. Adv Exp Med Biol, 473, 11-30.

Costello MF, Drobatz KJ, Aronson LR, King LG, 2004. Underlying cause, pathophysiologic abnormalities, and response to treatment in cats with septic peritonitis: 51 cases (1990-2001). J Am Vet Med Assoc, 225, 897-902.

El-Awady SI, El-Nagar M, El-Dakar M, Ragab M, et al., 2009. Bacterial translocation in an experimental intestinal obstruction model. C-reactive protein reliability? Acta Cir Bras, 24(2), 98-106.

Felts JF, Fox PR, Burk RL, 1984. Thread and sewing needles as gastrointestinal foreign bodies in the cat: a review of 64 cases. J Am Vet Med Assoc, 184(1), 56-59.

Ghosh A, Kukanich K, Brown CE, Zurek L, 2012. Resident cats in small animal veterinary hospitals carry multi-drug resistant enterococci and are likely involved in cross-contamination of the hospital environment. Front Microbiol, 3, 62.

Güngör S, Kurultay N, Şener AG, Er HH, et al., 2003. Demonstration of bacterial translocation in an experimental obstructive jaundice model in rats. Klimik J, 16(3), 121–125.

Hamilton E, Kaneene JB, May KJ, Kruger JM, et al., 2012. Prevalence and antimicrobial resistance of Enterococcus spp. and Staphylococcus spp. isolated from surfaces in a veterinary teaching hospital. J Am Vet Med Assoc, 240,1463-1473.

KuKanich KS, Ghosh A, Skarbek JV, Lothamer KM, et al., 2012. Surveillance of bacterial contamination in small animal veterinary hospitals with special focus on antimicrobial resistance and virulence traits of enterococci. J Am Vet Med Assoc, 240,437-445.

Litster A, Moss S, Platell J, Trott DJ, 2009. Occult bacterial lower urinary tract infections in cats-urinalysis and culture findings. Vet Microbiol, 136, 130-134.

Markey B, Leonard F, Archambault M, Cullinane A, et al., 2013. Section 3: Mycology. In: Clinical Veterinary Microbiology. Ed: Edwards R, Hewat C, Second edition, Mosby Elsevier, Missouri, USA, pp; 457-521.

Mulon PY, Desrochers A, 2005. Surgical abdomen of the calf. Vet Clin North Am Food Anim Pract, 21(1), 101-132.

Root CR, Lord PF, 1971. Linear Radiolucent Gastrointestinal Foreign Bodies in Cats and Dogs: Their Radiographic Appearance 1. Veterinary Radiology, 12(1), 45-52.

Schwarz S, Silley P, SimjeeS, Woodford N, et al., 2010. Assessing the antimicrobial susceptibility of bacteria obtained from animals. J Antimicrob Chemother, 65(4), 601-604.

Tenover FC, 2006. Mechanisms of antimicrobial resistance in bacteria. Am J Med, 119(6), 3-10.

Wagner KA, Hartmann FA, Trepanier LA, 2007. Bacterial culture results from liver, gallbladder, or bile in 248 dogs and cats evaluated for hepatobiliary disease: 1998–2003. J Vet Intern Med, 21, 417-424.

Author Contributions

Motivation / Concept: Kurtuluş Parlak, Semih Altan
Design: Kurtuluş Parlak, Semih Altan, Simten Yeşilmen Alp
Control/Supervision: Fahrettin Alkan
Data Collection and/or Processing: Eyüp Tolga Akyol, Elgin Orçum Uzunlu, Nuriza Zamirbekova
Analysis and/or Interpretation: Kurtuluş Parlak, Semih Altan, Simten Yeşilmen Alp
Literature Review: Kurtuluş Parlak, Semih Altan, Simten Yeşilmen Alp
Writing the Article: Kurtuluş Parlak, Semih Altan, Simten Yeşilmen Alp
Critical Review: Fahrettin Alkan

Ethical Approval

Selçuk University Experimental Research and Application Center, Animal Experiments Ethics Committee 09.07.2020, 2020/57 Number Ethics Committee Decision

CITE THIS ARTICLE: *Parlak K, Altan S, Alp Yesilmen S, Akyol TE, et al, 2022. Evaluation of bacterial translocation in cats undergoing laparotomy. Eurasian J Vet Sci, 38, 3, 168-172*