

# Perioperative Antibiotics Prophylaxis in Equine Surgical Colic Patients – Are We Doing the Right Thing?

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### ABSTRACT

Perioperative prophylaxis is one of the most common reasons for antimicrobial administration. Its goal is to reduce postoperative infection at the surgical site, thereby reducing morbidity, mortality and treatment costs. When perioperative prophylactic treatment is used, several issues should be decided upon, including the drugs that are used, timing of first administration, re-administration after 2 half-lives of the drug if surgery is still ongoing and duration of treatment. Equine colic surgery is typically an emergency procedure, classified in the best circumstances as a clean-contaminated surgical procedure and carries a high rate of surgical site infection as an important short term complication. Information regarding the compliance with prophylaxis guidelines in veterinary medicine is limited and is often not detailed enough. The duration of prophylactic treatment is a more complicated topic due to the high rate of post-operative complications in horses undergoing colic surgery. Guidelines for the judicious use of antimicrobial therapy recommend that antimicrobials should be administered for the shortest effective period possible to prevent the development of resistant pathogens. A recent study in surgical colic patients has shown no difference in the rate of incision infection with the use of perioperative antimicrobial therapy for 72 hours and for 120 hours, resulting in the conclusion that there is no benefit for the longer duration of prophylactic antimicrobial administration. Clinician's awareness for guidelines or standard protocols for antimicrobial drug use for equine patients undergoing surgery for colic is important. Implementing such guidelines, which should be reviewed and updated regularly, and reducing the amounts of perioperative antimicrobials that are being used are important goals which we all should strive for in order to reduce the emergence of resistant strains of bacteria that could affect our patients.

### REVIEW

Perioperative prophylaxis is one of the most common reasons for antimicrobial drug administration. Its goal is to decrease the likelihood of infection after exposure to bacteria during the surgical period (1). The use of perioperative prophylaxis has evolved greatly in the last 30 years. Improvements in the timing of initial administration, the appropriate choice of antibiotic agents, and shorter durations of administration, define its value in reducing surgical site infections while minimizing the risks for side effects (2). On the other hand, inappropriate use results in unnecessary

costs, increased antimicrobial resistance, and development of superinfections (3). Whereas much information is available in human medicine, objective scientific studies which evaluate the use of perioperative prophylaxis in veterinary medicine are limited and more studies are warranted. An American College of Veterinary Internal Medicine (ACVIM) consensus statement on antimicrobial drug use in veterinary medicine was issued several years ago (4). In recommendation I, it is stated that the committee believes that prophylactic and metaphylactic use of antimicrobial drugs is appropriate for control and prevention of infectious diseases

in animals. However, it is also stated that its use should be conservative and should emphasize drugs assigned to the primary use category. It is also stated that it is not necessary to use antimicrobial drugs in all surgical cases to prevent infections, which is especially true for clean surgeries, as opposed to clean-contaminated or contaminated procedures (4). Clean surgical wounds have an infection rate less than 5%, so antimicrobial prophylaxis is generally not necessary (3). Clean-contaminated wounds are those in which contaminated areas of the body (eg. gastrointestinal system, genitourinary system) are entered under controlled conditions without unusual contamination (3). Colic surgery in horses is typically an emergency procedure, classified in the best circumstances as a clean-contaminated surgical procedure (4). Surgical site infection (SSI) is one of the most common short-term complications in colic patients and can occur in as many as 22-40% of all cases (5, 6, 7).

When using prophylactic antibiotics, several aspects should be taken into accounts including the selection of appropriate agent, the timing of the first dose, re-administration of antibiotics during surgery after 2 half-lives of the drug have passed, and duration of treatment. Regarding the timing of the first dose, prophylactic antimicrobials must be present in appropriate levels at the surgical site during the time of contamination (3). In human patients, administration of the first dose of antibiotics more than two hours before surgery or three hours after surgery resulted in six times higher complication rate as opposed to patients that were treated 0-2 hours before surgery (8). Current guidelines for use in horses suggest that prophylactic antibiotics should be administered, preferably intravenously, within one hour of first incision (9). As for re-administration during surgery, in human patients undergoing colorectal surgery, the incidence of infection was decreased in patients that were administered repeated intraoperative dosing of antibiotics (10). Regarding re-administration of antimicrobials in veterinary patients if surgery is ongoing after 2 half-lives of the drug have passed, prophylactic beta-lactam antimicrobial administration should be repeated during surgery (3).

Information regarding the compliance with prophylaxis guidelines in veterinary medicine is limited. In a study reporting on prophylactic antimicrobial use in horses undergoing elective arthroscopy, only 6.3% received preoperative antibiotics within 60 minutes of the first incision (11). Although it is recommended that a second dose should be administered

in colic surgeries if the surgery is ongoing after 2 half-lives of the drug have passed in order to assure adequate levels for the duration of surgery, intraoperative antibiotic administration did not occur in any horse, in that study (11). These discrepancies can be partially explained by logistical reasons but it was suggested by the authors that adhering to these recommendations is preferable (11). In a recent study that investigated antimicrobial use in horses undergoing emergency colic surgery, only 88 (11.6%) horses received the appropriate preoperative dose within 60 minutes of the start of surgery and only 8 horses (1.8%) were re-dosed correctly (1).

The duration of prophylactic treatment is a more complicated topic due to the high rate of post-operative complications in horses undergoing colic surgery. Guidelines for the judicious use of antimicrobial therapy recommend that antimicrobials should be administered for the shortest effective period possible to prevent the development of resistant pathogens (4). Continued use of prophylactic antimicrobials beyond the conclusion of surgery contributes to the development of resistant bacteria, superinfections and nosocomial infections (3). While in horses undergoing elective arthroscopic surgery, most (66%) were treated for 24 hours or less (11), this is clearly not the common practice in colic patients. In 2006, Santschi suggested that equine surgeons should seriously consider reducing the duration of prophylactic antimicrobial use in their patients (9). Due to various reasons, among which is the high post-operative complication rate, it is still common practice in many equine hospitals to administer prophylactic antimicrobial therapy for 5 days, postoperatively, mostly aiming to reduce incisional complications (6, 12). This is also the current protocol at the Koret School of Veterinary Medicine – Veterinary Teaching Hospital (KSVM-VTH). In a recent study, the use of perioperative antimicrobial therapy for 72 hours and for 120 hours was compared, in order to evaluate its effect on the development of postoperative incisional infections. High post-operative incisional complication rate (42.2%) was found, but no differences were seen between the two tested groups, resulting in the conclusion that there is no benefit for the longer duration of prophylactic antimicrobial administration (6). The authors of that study suggested that further studies are warranted to identify the minimum effective duration of antimicrobial therapy as it is possible that even a shorter course of 1-2 days would be equally beneficial (6).

The last but not least decision when administering prophylactic antimicrobial is the selection of appropriate agent. As stated earlier, in the ACVIM consensus it is recommended that prophylactic antimicrobial use should be conservative and should emphasize drugs assigned to the primary use category. The most common antibiotic combination used in adult colic patients is penicillin G and gentamicin (1) which is in accordance with the ACVIM consensus. This is the standard antibiotic combination in the Royal Veterinary College and at the Bell Equine Veterinary Clinic, both in the UK, in colic patients (6). In a survey of 761 horses undergoing emergency colic in the New Bolton Center of the University of Pennsylvania, 89.3% were given potassium or procaine penicillin G and gentamicin and very few were given other drug combinations (1).

As stated earlier, inappropriate use of perioperative prophylaxis results in unnecessary costs, increased antimicrobial resistance, and superinfections (3). We cannot conclude inclusively, but it is possible that among other reasons, the recent emergence of multi-drug resistant (MDR) bacteria in the Large Animal Department of the KSVM-VTH is the result of such use of antimicrobials. During 2013 49% (27/55) isolates from different body sites in hospitalized horses at the KSVM-VTH were MDR (Berlin, personal communication). Multi-drug resistant bacteria are classified as those that are resistant to at least 3 groups of antimicrobials (13) and included 6/12 *Escherichia coli* isolates, 4/7 *Enterobacter* isolates, 7/8 *Klebsiella* isolates and 1/1 a *Salmonella* isolate which further emphasizes the problem of nosocomial infection and question the current prophylaxis antimicrobial use routine. Methicillin resistant *Staphylococcus aureus* was also isolated from both carrier horses and infected wounds during this year. Strict guidelines for the use of prophylaxis antimicrobial use in horses undergoing colic surgery is needed.

In a survey that was conducted little more than a decade ago among diplomats of the American College of Veterinary Surgeons, 28 of 32 respondents (88%) reported that they were unaware of any written guidelines or standard protocols for antimicrobial drug use for equine patients undergoing surgery for colic at their veterinary teaching hospital (14). A decade later, in a survey among UK equine surgeons, less than 1% of the practices had antimicrobial use guidelines (15). The authors emphasized the importance of implementation of such guidelines in any institution where antimicrobials are prescribed in order to maintain their

effectiveness (15). Implementing such guidelines, which should be reviewed and updated regularly, and reducing the amounts of perioperative antimicrobials that are being used is an important goal which we all should strive for in order to reduce the emergence of resistant strains of bacteria that could affect our patients.

In conclusion, in horses undergoing colic surgery, it is important to administer the first dose of antibiotics, within 60 minutes of the first incision. A second dose should be administered if the surgery is ongoing after 2 half-lives of the drug have passed. Prophylactic antimicrobial administration should be limited to no more than 72 hours and further studies are required to determine if even shorter duration is accepted.

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