

Antibiotic Prophylaxis in Gastro-Intestinal Surgery: An Evaluation of Current Veterinary Practices in Southwest Nigeria

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Abstract: A study on the use of prophylactic antibiotics in gastro-intestinal surgery by veterinary practices in southwest Nigeria was conducted to evaluate current practices using structured questionnaire and a retrospective study of hospital care records. The results indicated that the use of prophylactic antibiotics in surgery was embraced by all practices with Amoxicillin>Oxytetracycline>Ciprofloxacin>Penstrept and Penstrept>Oxytetracycline>Ciprofloxacin and Amoxicillin being the most prescribed antibiotics for general and gastro-intestinal procedures, respectively. Significant number of practices administered antibiotic prophylaxis for a duration of 5 or more days. All practices administered antibiotic prophylaxis post-operatively while 43.75 and 25.00% of practices also gave additional pre-surgical and peri-surgical doses, respectively. Only few practices (12.5%) insist on pre-surgical laboratory tests with complete blood count being the most requested analysis. Majority of practices have no protocol for aseptic preparation. It is concluded that the current veterinary practices investigated encouraged inappropriate antibiotic prescribing and may portend serious ecologic consequences in patients undergoing GIT surgery.

Keywords: Antibiotic prophylaxis, current practices, gastro-intestinal surgery

INTRODUCTION

The therapeutic use of antibiotics has proved to be of great benefit to veterinary surgeons in the relief of suffering and in saving of animal life. Antibiotics have also been used outside normal therapy for prophylaxis (Rosin *et al.*, 1993).

Effective antimicrobial therapy requires not only knowledge of the infectious agents of a particular animal species and their *in vitro* sensitivities to specific drugs, but also knowledge of the capacity of these drugs to penetrate sites of infection and of clinical responses to them in practice (Grace *et al.*, 2003). The biological nature of the pathogen decides its natural susceptibility or insusceptibility to a particular antibiotic, but some species of bacteria readily acquire resistance to the antibiotics to which they are naturally sensitive and the incidence of acquired resistance in these species is directly related to the intensity of antibiotic usage Livermore (2000) and Linton (1997). Despite the accepted use of antimicrobial prophylaxis in surgical procedures that have a high risk of infection and in surgical procedures in which the consequences of infection seriously endanger a patient or the success of an operation, its use remains controversial especially regarding the choice and duration of postoperative antimicrobial administration. The prolonged use of antibiotics is associated with an increased risk of drug

toxicity, a change in the antimicrobial susceptibility pattern of pathogens and an alteration in patient's intestinal flora (Bratzler and Houck, 2005; Linton, 1997; Fry *et al.*, 1981).

Emergence of antimicrobial resistance is an increasing concern in both human and veterinary medicine (Guardbassi *et al.*, 2004). Increased prevalence of antimicrobial resistance in various bacterial species from pet animals has been reported in the United States and the United Kingdom, with resistance generally associated with antimicrobial therapy (Guardbassi *et al.*, 2004; Prescott *et al.*, 2002). The role of previous antimicrobial therapy in the emergence of resistance is generally accepted; as is the role of selection pressure. Use of antimicrobial selects for resistance in commensal as well as pathogenic bacteria (Guardbassi *et al.*, 2004; Sorum and Sunde, 2002; Livermore, 2003).

The ability to prevent or limit colonization of the intestinal tract by pathogenic microorganisms has been termed colonization resistance (Van der Waaij, 1982). Today, there is evidence that the intestinal flora provides protection against a broad range of enteric pathogens (Hentges *et al.*, 1990). Antimicrobial therapy induces rapid and profound changes in the intestinal flora and disrupts colonization resistance already established there in Vollard *et al.* (1990), Rousenblatt and Brook (1993) and Edlund and Nord (2000). Gastro

intestinal surgeries are performed very commonly in small animal for biopsy excision of foreign body, upper gastro intestinal bleeding and resection of necrotic segments of the gastrointestinal tract among others Mathiesen (1993). The use of broad spectrum multiple dose antibiotic regime prophylaxis in gastrointestinal surgery is a common practice aimed at preventing post surgical infection (Page *et al.*, 1993). However, this practice has become controversial because of the imbalance in the microbial ecosystem caused by administration of antimicrobial agents. Colonization or overgrowth by resistant organisms that may spread within the body to cause infection have been attributed to the use of broadspectrum multiple dose antibiotic regime (Vollard and Clasener, 1992). In patient receiving antibiotic after gastrointestinal surgery, the normal intestinal flora is likely to undergo changes which are different from those seen in healthy subjects.

The goals of prophylactic administration of antibiotics to surgical patients are to reduce incidence of surgical site infection, use antibiotics in a manner that is supported by evidence of effectiveness, minimize the effect of antibiotics on the patients' normal bacterial flora, minimize adverse effects and cause minimal change to the patients host defense (Mangram *et al.*, 1999; Rosin *et al.*, 1993). In the realization of these goals, a large volume of data has been generated from several studies that investigated the utility of prophylactic antibiotics in surgery (Vollard *et al.*, 1994; Edlund and Nord, 2001; Page *et al.*, 1993; Scher, 1997; Dellinger *et al.*, 1994). Increasing rates of antimicrobial resistance following extensive use of antimicrobials has led to a worldwide interest in finding ways to inhibit the emergence of resistance. Consequent upon this, current research efforts are now geared towards providing a guideline on the use of antibiotics in surgery and to proffer evidence-based recommendations to reduce inappropriate prophylactic antibiotic prescribing. Many nations and healthcare stakeholders have embarked on similar projects with reviews being conducted from time to time in the light of ever increasing need to use antibiotics wisely and increasing prevalence of more resistant organisms.

There is a dearth of literature either on the prophylactic use of antibiotics in surgery or established guidelines on indications for surgical antibiotic prophylaxis and its benefits in Nigerian Veterinary practice.

The present study is designed to provide evidence for current practices pertaining to prophylactic antibiotic use in veterinary surgery and to provide a framework for audit and ecologic evaluation.

MATERIALS AND METHODS

A questionnaire was sent to veterinary clinicians in private and public service in southwest Nigeria. The study was conducted between the months of October 2011 and February 2012. The study was based in the Department of Veterinary Surgery and Reproduction, University of Ibadan. Data were obtained from some private and state-owned veterinary clinics/hospitals drawn from Oyo, Ogun, Osun, Ekiti, Ondo and Lagos states, including the Veterinary Teaching Hospitals of the University of Ibadan, Oyo state and the Federal University of Agriculture, Abeokuta, Ogun state. The respondents were asked questions with respect to current practice pertaining to prophylactic antibiotic use in Surgery. Respondents were asked questions under the following categories:

- Brief details of their practices
- Brief details of their clinical experience/exposure post-qualification
- Types of surgical facility
- Pre-surgical evaluation of patient
- Present use of biochemical/laboratory tests/sensitivity test
- Analyses regularly or occasionally requested
- Aseptic preparation protocol
- Incidence/frequency and recognition of post-surgical infection
- Use of prophylactic antibiotics in their practices with regard to preference/choice, duration, route, dose and complication encountered
- Preference/choice of antibiotic prophylaxis for gastro-intestinal and other procedures

In the second phase of the study, a retrospective evaluation of clinical case records were obtained from both private and public veterinary clinics and hospitals in Oyo, Ondo, Ogun, Osun, Ekiti and Lagos states of southwest Nigeria. An audit of surgical procedures performed between 2001 and 2010 was undertaken. Information on antibiotic prophylaxis (including dose, duration, route of administration and side effect/adverse reactions) used for the various surgical procedures during the period was obtained.

Data analysis: The data obtained from respondents and clinical case records were subjected to appropriate statistical analysis using SPCC package. Values were presented as mean±standard deviation (SD). A ($p<0.05$) was considered statistically significant.

RESULTS

Fifty eight questionnaires were sent out and replies were obtained from 23 practitioners representing 16

practices. Of these, 25% were small animal practices and 75% were mixed practices.

The type of antibiotics used for surgical prophylaxis by veterinary practices is shown in Fig. 1.

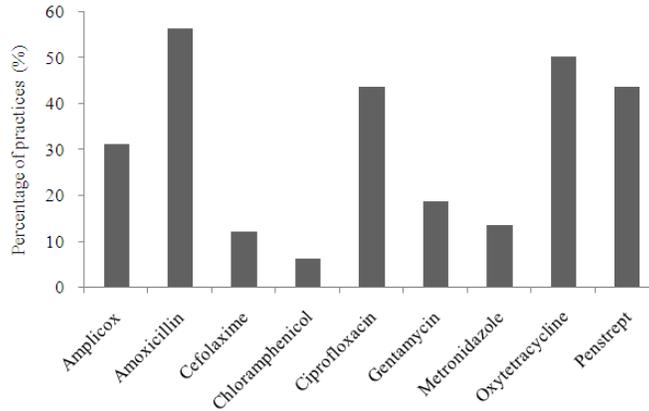


Fig. 1: The type of antibiotics used for surgical prophylaxis by veterinary practices

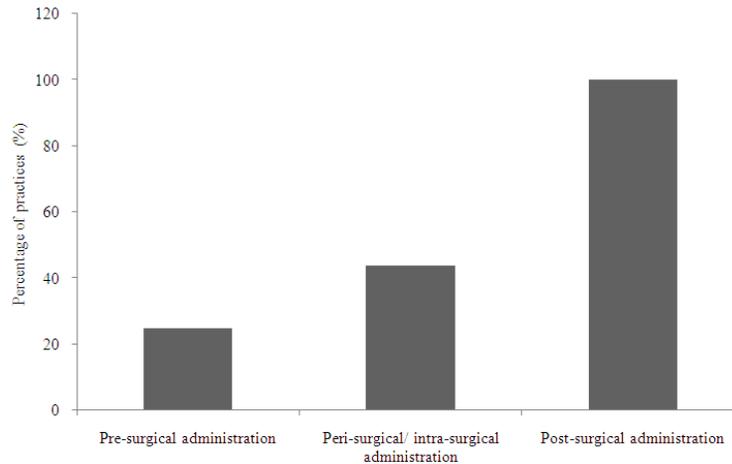


Fig. 2: Timing of administration of antibiotics used in surgical prophylaxis by veterinary practices

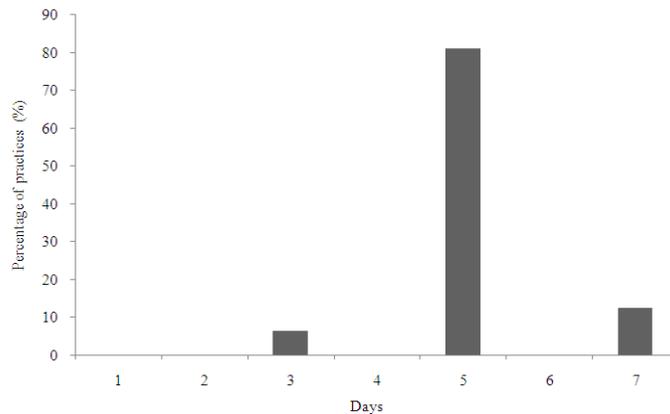


Fig. 3: Duration of antibiotic administration used in surgical prophylaxis by veterinary practices

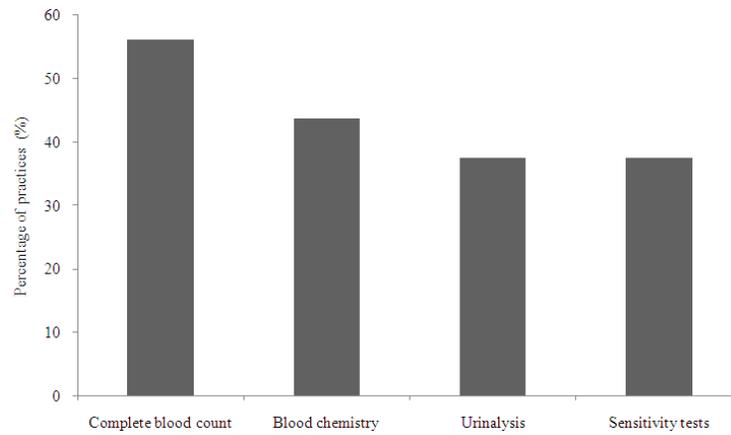


Fig. 4: The type of pre-surgical laboratory analysis requested by veterinary practices

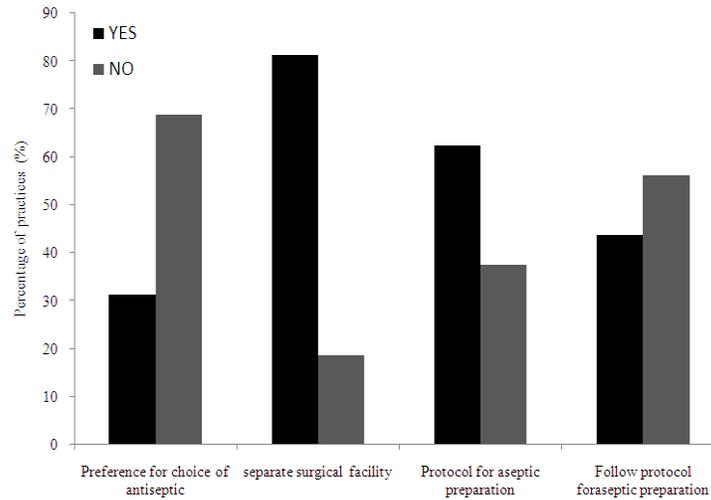


Fig. 5: Responses of practices to asepsis-related questions

Amoxicillin was the most preferred choice by practices (56.25%), followed by Oxytetracycline (50%) and Ciprofloxacin and Penstrept (43.75 and 43.75%, respectively).

Antibiotic prophylaxis was administered post-operatively by all practices while 43.75 and 25% of practices administered peri-surgically and pre-surgically, respectively (Fig. 2).

Figure 3 shows the duration of antibiotic administration used in surgical prophylaxis by veterinary practices. Majority of practices (81.25%) administered antibiotic prophylaxis for 5 days while 6.25 and 12.5% of practices administered antibiotics prophylaxis for 3 and 7 days, respectively. The type of pre-surgical laboratory analyses requested by veterinary practices is shown in Fig. 4. Complete blood count was requested by 56.25% of practices while 43.75, 37.5 and 37.5% of practices requested for blood chemistry, urinalysis and sensitivity tests, respectively.

Table 1: The antibiotics used for prophylaxis in gastro-intestinal surgery by veterinary practices

Antibiotic	(%) of practices
Penstrept	68.75
Metronidazole	37.50
Ampiclox	43.75
Amoxicillin	56.25
Oxytetracycline	62.50
Ciprofloxacin	56.25
Gentamycin	6.25

The antibiotic preference for gastro-intestinal surgery in veterinary practices is presented in Table 1. Penstrept, Oxytetracycline, Ciprofloxacin and Amoxicillin were the most preferred choice for surgical prophylaxis.

Response of practices to asepsis-related questions such as preference for choice of antiseptic, type of surgical facility, availability of protocol for aseptic preparation and percentage of practices that follow aseptic preparation protocol is presented in Fig. 5.

DISCUSSION

The goals of prophylactic administration of antibiotics to surgical patients are to reduce the incidence of post-operative wound infection, to use antibiotics in a manner that is supported by evidence of effectiveness, to minimize the effect of antibiotics on the patient's normal bacterial flora, to minimize adverse effects and to cause minimal change to the patient's host defenses.

Prophylaxis is indicated for procedures associated with high infection rates, those involving implantation of prosthetic materials and those in which the consequences of infection are serious. Inappropriate prophylaxis is characterized by unnecessary use of broad-spectrum agents and continuation of therapy beyond the recommended time period. Several studies have been performed investigating the utility of prophylactic antibiotics in surgery (Rosin *et al.*, 1993; Bratzler and Houck, 2005; Luchette *et al.*, 2006). However, studies to provide the evidence for current practices with regard to prophylactic antibiotic use in surgery by veterinarians in Nigeria are yet to be documented. The present study aimed at providing appropriate data and a framework for audit and ecologic evaluation of the use of prophylactic antibiotics in surgery.

In the present study, fifty-eight questionnaires were sent out and replies were obtained from twenty-three practitioners representing sixteen practices. The results of an audit of surgical procedures obtained through a retrospective study of clinical case records of some private and public veterinary clinics and hospitals in south-west Nigeria were also documented.

Generally, we observed that most practices did not keep proper records especially with respect to the weight of animals, the timing, duration, dosing and route of administration of antibiotics. In some cases, there were abrupt termination of therapy and continuation after 2 or 3 days. Most practices lack protocol for documenting surgical and anesthetic procedures. Records of the effectiveness and adverse reaction to prophylactic antibiotic use in surgery was either poorly documented or non-existent. Our investigation also revealed that all the respondents/veterinarians embraced the use of different types of antibiotics as prophylaxis during surgery. No class of antibiotic was spared in this regard.

It was observed that the use of prophylactic antibiotics cut across all practices and procedures. The study equally revealed that no consideration was accorded the appropriateness, the type, timing and duration of antibiotic administration in surgical patients -all of which contradict the fundamental principles of

antibiotic prophylaxis in surgery (Rosin *et al.*, 1993). Empiric rather than prophylactic regimes, in which therapy is continued after the operative procedure was the protocol embraced in all practices.

Inappropriate use of antibiotic prophylaxis observed in this study was characterized by post-operative administration of antibiotics for 5 or more days in most surgical procedures. This practice has the potential to increase the risk of adverse effects and promote the emergence of resistant organisms (Bratzler and Houck, 2005).

The choice of antibiotics for surgical prophylaxis must be tailored towards micro-organisms most likely to cause post-operative wound infection (Rosin *et al.*, 1993; Luchette *et al.*, 2006). From several studies elsewhere that investigated the utility of prophylactic antibiotics in surgery, reports have emerged that support different practices. The reports of Fabian *et al.* (1992), Bozorggadeh *et al.* (1999) and Luchette *et al.* (2006) indicated that complicated, contaminated or dirty procedures should receive additional post-operative coverage.

Bratzler and Houck (2005), H.H.S. (2006) and S.I.P. (2006) were of the opinion that prophylactic antibiotics should be administered within one hour prior to incision. It was also suggested that during long procedures, antibiotic prophylaxis should be re-administered every 3 h Bratzler and Houck (2005). Our findings, however, in this study revealed that the current practices by veterinarians in the areas covered did not conform with any of these evidence-based suggestions. As increasing volume of data continue to be generated from several studies investigating the utility of prophylactic antibiotics in surgery, the time is apt for veterinarians to direct their research efforts at providing an acceptable guideline on the prophylactic use of antibiotics in surgery. This will, no doubt, provide evidence-based recommendations that will reduce inappropriate prophylactic antibiotic prescribing and minimize the risk of emergence of drug resistance in animals. Also from a public health viewpoint, there should be concern as to the possible outcome of the over-use of anti-microbial agents currently practiced by veterinarians. Gastro-intestinal infections with bacteria unresponsive to any anti-microbial agents are possible sequelae (Levy, 2002; Prescott *et al.*, 2002).

With respect to the type of antibiotics used for surgical prophylaxis by veterinary practices, our study revealed that Amoxicillin, Oxytetracycline, ciprofloxacin and Penstrept were the most prescribed antibiotics in decreasing order of preference for general surgery, while Penstrept, Oxytetracycline, Ciprofloxacin and amoxicillin were the most prescribed antibiotics for gastro-intestinal surgery. Beta-lactam

group comprising of amoxicillin and penicillins was the most preferred choice by most practices. Being one of the most important group of antimicrobial agents widely used in human and veterinary medicine (Livermore, 2000), the injudicious and inappropriate use of this group of antibiotics as currently practiced may contribute to the emergence of resistant bacterial strains (Rosin *et al.*, 1993). Mentula (2005) in his report had shown that beta-lactamases have the potential to inhibit the emergence of resistance and preservation of the microbiota during anti-microbial therapy. We therefore suggest that consideration be given to the administration of this enzyme in animals receiving beta-lactam antibiotics.

Although, pre-surgical laboratory analyses were requested by many practices, the results of such analyses and other essential laboratory values were not always available at the time of prophylactic antibiotic administration. The evidence or justification for the indication was therefore either lacking or not documented.

Response to aseptic-related questions indicated that majority of practices have separate surgical facility for operative procedure and protocol for aseptic preparation (62.50%). However, 56.25 and 68.75% of practices neither followed the protocol for aseptic preparation nor have preference for the choice of antiseptic, respectively. This finding to us, suggest that most practices probably rely more on the use of antimicrobial agents for the prevention of surgical infection, rather than good surgical techniques and adherence to aseptic principles. Evidently, all the practices administered prophylactic antibiotics for five days or more to cover lapses in aseptic preparations. Since no antibiotic now available is free of side effects, the current practices among veterinarians should be discouraged. Antibiotics should be seen not as a substitute for asepsis, gentle handling of tissue, meticulous hemostasis, judicious use of suture materials and accurate apposition of tissue without obstructing blood supply (Rosin *et al.*, 1993).

From the findings in this study, we are of the opinion that the current veterinary practices in southwest Nigeria encouraged inappropriate antibiotic prescribing with regard to choice, timing, duration and documentation. This may portend serious ecologic consequences and emergence of resistance in gastrointestinal surgical patients.

Further studies are recommended to:

- Determine an appropriate antibiotic regime for all types of high-risk surgeries including the type, route and dose of antibiotics

- Develop protocol to clearly delineate responsibility for prophylactic antibiotic administration and documentation
- Development of protocol that will take into consideration the choice, route, dose and appropriate time frame for prophylactic antibiotic administration during surgery
- In order to strengthen infection control and patient safety, aggressive education of all stakeholders should be pursued vigorously especially in the key areas of culture and practices
- Medical record keeping should be given special consideration among the themes for continuing education being organized by the Veterinary Council of Nigeria.

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