CHAPTER 8

PROPHYLACTIC ANTIBIOTIC USE IN ELECTIVE FOREFOOT SURGERY

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The incidence of postoperative infection in clean orthopedic surgery has been reported as 0.5-6.5%.[1-5] Moreover, the incidence of postoperative infection is approximately 2-5% in extra-abdominal surgeries, and up to 20% in intra-abdominal surgery.[6] Although the incidence rate of postoperative wound infection in clean, elective foot and ankle surgery is considerably lower than that observed in abdominal surgical cases, the implications of postoperative bone and joint infection convey significant patient morbidity, and prophylactic antibiotic use in these patients warrants careful consideration. For this reason, antibiotic prophylaxis is commonly employed to assist in the prevention of postoperative infection in podiatric surgery, even in clean, elective cases. Although several authors[1-5,7-9] have advocated the use of prophylactic antibiotic therapy, this practice is not risk-free. In particular, the development of resistant organisms has been identified as a complication of the overuse of prophylactic antibiotics.

Indeed, prophylaxis need not be implemented for every surgical procedureand to various factors guide the surgeon's decision to either use or avoid the use of prophylactic antibiotic therapy. Understanding and identifying these factors are important in the determination of not only the appropriate antibiotic and its administration, but also the conditions that indicate the use of antibiotic prophylaxis in the podiatric patient. With the advent of resistant organisms, the administration of prophylactic antibiotics for clean, elective podiatric surgery has become a rather controversial topic. The purpose of this retrospective case control pilot study is to compare the incidence of postoperative infection in patients receiving prophylactic antibiotics while undergoing elective forefoot surgery, with a control group of surgical patients undergoing the same type of surgery without the administration of prophylactic antibiotics.

LITERATURE REVIEW

Surgical antibiotic prophylaxis is defined as the administration of antibiotics without clinical evidence of infection in the operative field. In 1961, Burke[10] was the first to demonstrate the timing of prophylactic antibiotic use. His studies showed that antibiotics only cause maximum suppression of infection if given before the bacteria gain access to the tissue, and have little effect when given three hours postcontamination. Nichols[9] recommended that delivery of antibiotics one hour before surgery results in therapeutic drug levels at the operative site and surrounding tissues. As a general rule, a single dose of parenteral antibiotics within 30 minutes before an operation provides adequate prophylaxis for one to two hours of surgery.[11] This time coincides with the amount of time needed for most elective forefoot surgical procedures. In addition, to ensure that adequate bone and soft tissue levels are reached at the surgical site, antibiotics must be given before inflation of a tourniquet.[11]

There are many factors that increase the risk of postoperative infection, including immunocompromised stat, contaminated or "dirty" procedures, foreign material implantation and acute trauma patients. Antibiotic prophylaxis should be used in all these individuals. However, most elective forefoot reconstructive surgeries are considered "clean" orthopedic surgeries. The National Research Council classifies a "clean" wound as a non-traumatic, non-infected surgical wound in which an organ lumen has not been entered.[12] Therefore, antibiotic prophylaxis is not routinely indicated in this "clean" operative patient population. Since the infection rate is less than 2% in these "clean" surgeries, few studies have been performed concerning podiatric surgery and prophylaxis.[11]

Lastly, prolonged exposure of a surgical wound to the surrounding environment greatly increases the risk of postoperative infection. According to Joseph and Kominski,[11] airborne organisms from either the patient's skin or the operating room staff account for 90% of the contaminants found in surgical wounds. Because of this,

antibiotic prophylaxis is generally used in surgical procedures lasting more than two to three hours. However most forefoot elective reconstructive surgeries are less than two hours in length, so prophylaxis is not necessarily indicated.

PRELIMINARY STUDY DESIGN AND INTENT

At our urban medical center, we initiated a retrospective cohort of patients undergoing elective forefoot surgery with and without prophylactic antibiotic administration. Patients were evaluated for the incidence of postoperative infection following forefoot reconstructive surgery, with respect to antibiotic prophylaxis. The types of forefoot reconstructive surgery included in the study were hallux abductovalgus repair, hammertoe and metatarsophalangeal joint repair, excision of intermetatarsal neuroma, lesser metatarsal osteotomies, and removal of internal fixation devices. Patients were categorized into two groups: those patients having received prophylactic antibiotics prior to surgical intervention and those who did not receive prophylactic antibiotic therapy. The decision to use prophylactic antibiotic therapy was made on the basis of the individual attending surgeon's preference. All of the patients were evaluated preoperatively by one of four attending surgeons on the teaching staff of the Presbyterian Medical Center of the University of Pennsylvania Health System, in Philadelphia. Surgery was then performed and the patients followed postoperatively in the attending surgeon's private practice following discharge from the hospital. All of the patients included in the study were generally healthy and they were classified as either ASA Class 1 (healthy) or ASA Class 2 (controlled systemic disease). Only patients without a history of ulceration, open wound, open fracture, infection, or prior surgery for any of these conditions, were included in the study.

A variety of different patient variables were statistically analyzed to determine the rate of postoperative infection for each of the study groups, and whether or not a significant difference exists between the rate of infection in each group. Because of the relatively low prevalence of postoperative infection associated with clean, elective orthopedic surgery observed nationwide, our sample was evaluated to establish the interrelationship between the operative exposure and prevalence of postoperative infection in our urban hospital population.[13] The variables

Table 1

Preoperative Parameters

- Age
- Sex
- Systemic disease
- Current medications
- Allergies
- Tobacco use

Operative & Postoperative Parameters

- ASA Classification
- Method of anesthesia (local, local with IV sedation, general, spinal)
- Method of hemostasis
- Duration of surgery
- Presence of deep metal fixation device/s
- Presence of percutaneous Kirschner wires
- Suture material deep
- Suture material skin
- Dressing material
- Postoperative medication
- Operative infiltration of corticosteroid
- Time to the first postoperative visit

Table 2

LOCAL CLINICAL DIAGNOSTIC CRITERIA FOR POSTOPERATIVE WOUND INFECTION*

- Erythema
- Local increase skin temperature
- Edema
- Pain
- Drainage
- Dehiscence

***Generally associated with core temperature > 100.4°F, and subsequently confirmed with microbiological culture.**

identified in this study include: age, sex, past medical history, current medications, allergies, tobacco use, ASA Classification, method of anesthesia, method of hemostasis, duration of surgery, the presence of deep metal fixation devices, the presence of percutaneous Kirschner wires, type of suture and dressing materials used, operative infiltration of corticosteroid, postoperative medications used, and the time to the first postoperative dressing change. These parameters are divided into perioperative parameters as shown in Table 1.

Patients displaying clinical signs of postoperative infection were identified, and the incidence rate of postoperative infection was calculated. Table 2 depicts the local signs and symptoms used to determine the presence of postoperative infection. Although these clinical signs and symptoms need not necessarily relate just to postoperative wound infection, for the purposes of this study we defined the endpoint (postoperative infection) based on the presence of clinical findings that warranted initiation of antibiotic therapy. Other conditions such as seroma, hematoma, sterile abscess or dehiscence could also prompt the clinician to initiate antibiotic therapy in the postoperative phase, however confirmation of infection by wound culture and sensitivity testing was recorded as the only absolute measure of infection. Endpoints were defined as either the absence of infection, or an initial healing phase that was unremarkable relative to the presence of the clinical signs and symptoms indicative of infection, or the microbiological diagnosis of a postoperative infection.

To date, we have collected data for 332 surgical cases, however the interim results of this study have not yet been calculated, and no inferences have been determined. A stratified analysis will be performed in an effort to control for potential bias based on the wide range of clinical variables observed. In accordance with our current timeline for this project, it is our intention to report these results for patients undergoing elective reconstructive forefoot surgery by Spring of 2003.

REFERENCES

1. Stevens DB. Postoperative orthopaedic infections. *J Bone Joint Surg Am* 1964;46:96-102.
2. Pavel A et al. Prophylactic antibiotics in clean orthopaedic surgery. *J Bone Joint Surg Am* 1974;56:777-82.
3. Mini E, Nobili S, Periti P. Methicillin resistant staphylococci in clean surgery. *Drugs* 1997;54:39-52.
4. Bernard HR, Cole WR. The prophylaxis of surgical infection: the effect of prophylactic antimicrobial drugs on the incidence of infection following potentially contaminated operations. *Surgery* 1964;56:151-6.
5. Williams DN, Gustillo RB. The use of preventive antibiotics in orthopaedic surgery. *Clin Orthop Rel Res* 1984;190:83-8.
6. CMS/CDC National Surgical Infection Prevention, Medicare Quality Improvement Project
7. Mader JT, Cierney G. The principles of the use of preventive antibiotics. *Clin Orthop Rel Res* 1984;190:75-82.
8. Boyd RJ, Burke JF, Colton T. A double blind clinical trial of prophylactic antibiotics in hip fractures. *J Bone Joint Surg Am* 1973;55:1251-9.
9. Nichols RL. Use of prophylactic antibiotics in surgical practice. *Am J Medicine* 1981;70:686-91.
10. Burke JF. The effective period of preventative antibiotic action in experimental incisions and dermal lesions. *Surgery* 1961;50:161.
11. Joseph WS, Kominski MA. Prophylaxis in lower extremity infectious diseases. *Clin Pod Med Surg* 1996;13:647.
12. Reyes C, Barnauskas S, Hetherington V. Retrospective assessment of antibiotic and tourniquet use in an ambulatory surgery center. *J Foot Ankle Surg* 1997;36:55.
13. McMichael AJ, et al., Chronic respiratory symptoms and job type within the rubber industry. *J Occup Med* 1976;18:611.