

# A Prospective Evaluation of Adverse Reactions to Single-Dose Intravenous Antibiotic Prophylaxis During Outpatient Hand Surgery

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## Abstract

**Background:** While it is established that routine prophylactic antibiotics are not needed for all hand surgery, some cases do require it. The purpose of this study was to determine the rate of adverse reactions resulting from prophylactic antibiotic administration on patients undergoing outpatient hand and upper extremity surgical procedures. We hypothesize that the rate of complications resulting from the use of antibiotic prophylaxis is smaller than that reported in the currently referenced literature. **Methods:** We prospectively evaluated 570 consecutive patients undergoing outpatient upper extremity surgery. Patients were excluded if they were on antibiotics prior to surgery, were discharged on antibiotics, or if they wished to be excluded. Nineteen patients were excluded, resulting in a study cohort of 551 patients. Patients were monitored perioperatively, 2 to 3 days postoperatively, during the first postoperative visit and 1 month postoperatively for adverse reactions. The type and timing of the adverse reaction was recorded. **Results:** Five hundred fifty-one patients were included for evaluation and 8 patients (1.5%) developed an adverse reaction to antibiotics. Five patients (0.9%) reported a rash and 3 patients (0.5%) reported diarrhea within 3 days of surgery. There were no anaphylactic reactions or complications necessitating hospital transfer or admission in the postoperative period. **Conclusion:** This study represents a prospective investigation designed to determine the rate of adverse reactions to single-dose antibiotics given during outpatient hand surgery. We conclude that the use of intravenous, single-dose prophylactic antibiotic is safe in the outpatient setting for cases that require it.

**Keywords:** outpatient hand surgery, antibiotics, prophylaxis

## Introduction

Antibiotic prophylaxis has been traditionally used to decrease the risk of postoperative surgical site infections.<sup>9</sup> Studies have debated the effectiveness of such practices in elective orthopedic surgery compared to the potential risks of antibiotic adverse events.<sup>3,6,8,13,14,21,22,24</sup> Some studies advocate for continued use of antibiotics to decrease surgical site infections, but others demonstrate no benefit.<sup>2,4,6,11,12,13,22</sup> While it is established that routine prophylactic antibiotics are not needed for all hand surgery, some cases do require it.<sup>4,5,8,14,16</sup>

Cost, the development of bacterial resistance, and adverse reactions to the antibiotic medications are the most commonly listed detrimental factors in routine prophylaxis. A recent study referenced an adverse event rate of up to 10% during penicillin administration.<sup>6,10</sup> A review of the available literature reveals these data to be primarily

historic in nature or garnered in the setting of the treatment of burn patients.

While routine use of antibiotics is not necessary in all hand surgery, there are procedures that do require prophylaxis such as those that require hardware implantation.<sup>4,5,8</sup> There is little to no information regarding the rate of adverse events with the use of antibiotic prophylaxis in current medical practice, specifically as it relates to outpatient surgical procedures. The purpose of this study was to determine the rate of adverse events resulting from prophylactic antibiotic

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administration on a patient population undergoing outpatient hand and upper extremity surgical procedures. We hypothesize that the rate of complications resulting from the use of antibiotic prophylaxis is smaller than that reported in the currently referenced literature.

## Materials and Methods

Institutional board approval was obtained prior to the initiating the study. We prospectively evaluated 570 consecutive patients undergoing outpatient surgery by 1 of 4 hand and upper extremity surgeons at four outpatient surgical centers. The administration of antibiotic prophylaxis was at the discretion of the treating surgeon. A single-dose intravenous antibiotic was administered prior to incision. The type of antibiotic used and whether it was administered was at the discretion of each individual surgeon. Generally, patients were given a first-generation cephalosporin (cefazolin, 1 g;  $n = 464$ ). In cases with a history of a cephalosporin or penicillin allergy, clindamycin (600 mg;  $n = 84$ ) was administered. Vancomycin (1 g) was prescribed in one patient with a penicillin and clindamycin allergy. Patients were excluded if they were on antibiotics in the week prior to surgery, were discharged on antibiotics, or if they wished to be excluded from the study. Nineteen patients were excluded, resulting in a study cohort of 551 patients.

Demographic information, body mass index (BMI), type of procedure, and history of antibiotic allergies were gathered from the clinic and surgical center medical record. To determine the occurrence of an adverse reaction, patients were monitored as follows: (1) perioperatively (during the antibiotic administration, intraoperatively, and prior to discharge from the surgical center); (2) contacted by phone 2 to 3 days postoperatively; (3) during the first postoperative visit in the clinic; and (4) contacted by phone 1 month postoperatively. Data recorded included emergency department transfer from the surgical center or in the postoperative period, the presence of any allergic symptoms including hives and/or rash, diarrhea, and the use of any medications or other interventions to address any of these complications. The type and timing of the adverse reaction was recorded.

## Results

The study group consisted of 298 women (54%) and 253 men (46%) with an average age of 54 years (range 12-102). The average BMI of the group was 27.8 (range 14-48). One hundred forty-two patients (26%) had a bony procedure while 409 (74%) had a soft tissue procedure. On the surgical intake form, 133 patients (24.1%) reported a previous allergy to at least one antibiotic: 102 (18.5%) to one antibiotic, 21 (3.8%) to two antibiotics, and 10 (1.8%) to three or more antibiotics. The most common allergy was to penicillin or penicillin derivatives ( $n = 86$ ,

64.6%), followed by sulfa ( $n = 34$ , 25.5%), cephalosporins ( $n = 15$ , 11.3%), macrolides ( $n = 13$ , 9.7%), and fluoroquinolones ( $n = 10$ , 7.5%). Only two patients reported an allergy to clindamycin.

Eight patients (1.5%; 95% CI, 0.6-2.5%) developed an adverse reaction to antibiotics (Table 1). Five patients (0.9%) reported a rash: two patients developed the rash during the administration of antibiotics at the surgical center, and three patients developed a rash within 2 days following surgery. All patients reported resolution of their rash prior to their 2-week postoperative visit. Three patients (0.5%) reported diarrhea within 3 days of their surgery. All three patients reported resolution of their diarrhea prior to their 2-week postoperative visit without need for further antibiotic or hospitalization. There were no anaphylactic reactions or other complications necessitating hospital transfer or admission in the postoperative period.

## Discussion

While routine use of antibiotics is not necessary in hand surgery, there are some procedures that do require prophylaxis, such as those that involve the application of metal implants.<sup>6,10,15,19,21</sup> At present, high-level evidence remains absent in the existing literature regarding the administration of prophylactic antibiotics for a clean, elective, nonarthroplasty surgery and its impact on reducing postoperative surgical site infections. The development of antibiotic resistance, adverse reactions to the antibiotics, and cost are often cited as factors in deciding against the routine use of antibiotic prophylaxis.<sup>7,14,18,22,23</sup>

In a retrospective study evaluating the impact of antibiotic prophylaxis in outpatient elective hand surgery procedures, Bykowski et al indicate a 5% to 10% incidence of adverse reaction to antibiotic administration.<sup>6</sup> The study referenced in this article investigated adverse reactions to inpatient administration of penicillin and ampicillin, which are not routinely nor currently administered for outpatient antibiotic prophylaxis. Similarly, Dunn et al, in a review of current evidence of prophylaxis, cite multiple studies describing rates of up to 26% of adverse reactions to antibiotic administration.<sup>10</sup> A careful review of these references reveal that most of the antibiotics used in these studies are not typically used for prophylaxis during outpatient surgery, including amoxicillin/clavulanate and ciprofloxacin. Moreover, the setting for these studies was generally in inpatient burn units, where patients with other, significant comorbidities may be more likely to result in adverse reactions. Finally, Harness et al, in a study evaluating the use of antibiotics during outpatient carpal tunnel surgery, alludes to the risk of adverse events with prophylaxis.<sup>13</sup> As previously mentioned in these studies, the references cited supporting these assertions were largely based on the historic references mentioned previously.

**Table 1.** Patient Adverse Reaction to Antibiotics.

Patient	Age	Sex	Comorbidities	Antibiotic (dose)	Reaction	Surgery
1	68	M	Hyperlipidemia, coronary artery disease, hypothyroid	Cefazolin (1 g)	Rash	Mass excision
2	73	F	Hypertension, osteoporosis, scoliosis	Cefazolin (1 g)	Rash	CTR
3	63	F	High cholesterol	Clindamycin (600 mg)	Rash	CTR
4	44	F	Asthma, anxiety, depression	Cefazolin (1 g)	Rash	ECU sheath reconstruction
5	36	F	None	Cefazolin (1 g)	Rash	Arthroscopic TFCC repair
6	86	M	Abdominal aortic aneurysm, diabetes, hypertension	Cefazolin (1 g)	Diarrhea	Trigger finger release
7	50	F	Diabetes, migraines, asthma, hyperlipidemia	Cefazolin (1 g)	Diarrhea	Trigger finger release
8	80	F	Hypertension, left bundle branch block	Clindamycin (600 mg)	Diarrhea	CTR

Note. CTR = carpal tunnel release; ECR = extensor carpi ulnaris; TFCC = triangular fibrocartilage complex.

In this study, we found a low rate of adverse reactions (1.5%) to antibiotic prophylaxis. While the choice of antibiotic was left to the discretion of the treating surgeon, a first-generation cephalosporin was most commonly used, with clindamycin administered to those reporting a penicillin and/or cephalosporin allergy. There is a paucity of data regarding the rate of adverse reactions to prophylactic antibiotics in current, outpatient surgical practice. In a study similar to ours, evaluating the rate of complications during outpatient breast surgery, Throckmorton et al found a zero percent rate of antibiotic-related complications in patients receiving preoperative prophylaxis.<sup>20</sup>

In addition to the low complication rate, we found that almost one-quarter of the patient cohort reported an allergy to an antibiotic, with an allergy to penicillin (15.6%) being the most commonly mentioned. Rash was the most common reaction and the majority of patients who developed an adverse reaction were female. These figures are in line with those described in the literature.<sup>1,17</sup>

Limitations of this study include the lack of a control group, which did not receive antibiotics, to compare post-operative reactions. Second, it is possible that some of the adverse reactions described may not have been related to the administration of the antibiotic, with the exception of the two patients who developed reactions while the antibiotic was infusing. We attempted to control for this limitation with close and frequent follow-up and specific questioning regarding medications or other potential causes of reactions. An adverse reaction unrelated to antibiotics would represent a false-positive datum, which would tend to overstate the already low adverse reaction rate, supporting our argument that routine prophylactic antibiotic administration is safe. In addition, these patients had surgery performed at an outpatient facility, which selects patients with lower comorbidities, a cohort which may be less susceptible to adverse events. Finally, it is possible that larger

doses of antibiotics (eg, 2 g of cefazolin) may lead to a higher incidence of adverse reactions.

To our knowledge, this study represents the first prospective investigation designed to determine the rate of adverse reactions to single-dose antibiotics given during outpatient hand surgery. While routine use of antibiotics is not necessary in hand surgery, there are procedures such as those which require hardware implantation which do require prophylaxis. We conclude that the use of intravenous, single-dose prophylactic antibiotic is safe in the outpatient setting.

### Ethical Approval

This study was approved by our institutional review board.

### Statement of Human and Animal Rights

Procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

### Statement of Informed Consent

This study does not disclose any identifiable information so informed consent was not sought or required.


### Declaration of Conflicting Interests

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