

16. Hueston JT. 'Firebreak' grafts in Dupuytren's contracture. *Aust N Z J Surg* 1984;54:277-81.
17. Strickland JW. The coverage of difficult digital defects with local rotation flaps. In: Strickland JW, Steichen WB, eds. *Difficult problems in hand surgery*. St. Louis: The CV Mosby Company, 1982:38-44.
18. Hueston JT. Limited fasciectomy for Dupuytren's contracture. *Plast Reconstr Surg* 1961;27:569-85.
19. Zachariae-L. Extensive versus limited fasciectomy for Dupuytren's contracture. *Scand J Plast Reconstr Surg* 1967;1:150-3.
20. Honner R, Lamb DW, James JIP. Dupuytren's contracture, long term results after fasciectomy. *J Bone Joint Surg* 1971;53B:240-6.
21. Green TL, Strickland JW, Torstrick RF. The proximal interphalangeal joint in Dupuytren's contracture. In: Strickland JW, Steichen WB, eds. *Difficult problems in hand surgery*. St. Louis: The CV Mosby Company, 1982:414-18.

Role of antibiotics in open fractures of the finger

The role of antibiotics was investigated prospectively in 91 open fractures of the finger. Antibiotics were administered to alternate patients with open phalangeal fractures. Only finger fractures distal to the metacarpophalangeal joint were included. Both groups were treated with aggressive surgical irrigation and debridement. In four patients in each group clinical signs of infection eventually developed; osteomyelitis did not develop in any patients, and no secondary surgical procedures were required in either group. This data indicates that vigorous irrigation and debridement is adequate primary treatment for open phalangeal fractures in fingers with intact digital arteries. (J HAND SURG 1990;15A:761-4.)

Mark D. Suprock, MD, *Oklahoma City, Okla.*, John M. Hood, MD, and John D. Lubahn, MD, *Erie, Pa.*

The use of antibiotics in the treatment of open fractures of the long bones is widely accepted as standard treatment and their effectiveness has been proven in random prospective studies by Patzakis and associates¹ and Gustilo and Anderson.² Routine use of antibiotics in managing open fractures of the finger is less common and there is a noticeable paucity of objective literature to either support or refute their importance.

The effectiveness of antibiotics in grossly contaminated or marginally viable wounds has been established by Burkhalter et al.³ and Cooney et al.⁴ Isolated soft

tissue wounds in the upper extremity may be treated with local care alone without the increased risk of infection as shown in two separate studies by Grossman and colleagues⁵ and Thirlby and associates.⁶ Wavak⁷ studied 100 consecutive hand injuries treated early with antibiotics and noted an infection rate of approximately 6%.

A review of five basic text books, Lister,⁸ Buck-Gramcko,⁹ Beasley,¹⁰ Flatt,¹¹ and Green¹² revealed a unanimous recommendation that antibiotics not be routinely used in the management of acute hand injuries. Coyle and Leddy,¹³ on the other hand, recommended that antibiotics are advisable for injuries in the distal finger.

Two studies deal directly with the role of antibiotics in finger fractures. Sloan et al.¹⁴ analyzed distal phalangeal fractures prospectively and found a 30% increase in the incidence of infection when antibiotics were not used. All amputations in this group, however, were treated by primary closure with either free graft or V-Y flap. Peacock et al.¹⁵ noted an increased risk of side effects with antibiotics, as well as, a potential

From the Orthopaedic Department, Hamot Medical Center, Erie, Pa. Received for publication April 20, 1989; accepted in revised form Sept. 3, 1989.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

Reprint requests: John D. Lubahn, MD, 300 State St., Suite 205, Erie, PA 16507.

3/1/16987



Fig. 1. A-D. A, Open fracture in an 18-year-old right-handed man. B, Films before and after intraosseous wire fixation of the fracture.



Fig. 1. Cont'd. C, Final result showing extension and flexion of the thumb 3 months later. D, Final result showing extension and flexion of the thumb three months later.

cultivation of resistant organisms. They concluded that use of antibiotics should be reserved for more serious injuries or specifically identified infections.

Materials and methods

From January 1, 1986 through January 31, 1988, all open finger fractures referred to the senior author were prospectively analyzed and randomly selected to be either treated with or without antibiotics. A total of 91

patients were followed-up in this study. The treatment for those receiving antibiotics was either a first generation cephalosporin, dicloxacillin, or erythromycin. A three-day course of antibiotics was prescribed. Only fractures in the finger distal to the metacarpophalangeal (MP) joint were included. Patients with damage to one or both digital vessels were excluded. Patients, under regional or metacarpal block anesthesia, in both groups were treated surgically with aggressive irrigation and



Fig. 2. A, Open fracture and amputation distal phalangeal level long and ring finger. B, Wounds granulating at 3 weeks postinjury. C, Healed fingertips 1 year from injury date, with mild hook nail deformity.

debridement. Forty-five of the 91 patients received oral antibiotics and 46 did not. Nail bed injuries with associated distal phalangeal fractures were treated with wound closure, and amputations were left open. Four patients from each required internal fixation with Kirschner (K-)wires. Patients in the group receiving antibiotics and in the group that did not receive antibiotics had similar numbers of fractures in the distal, middle, and proximal phalanges (Table I). No patients were excluded from this study because of underlying diseases such as diabetes or peripheral vascular disease. Likewise, no patients were excluded because of potential bacterial contamination. Two farmyard injuries were included in the group receiving antibiotics and one in the group that did not receive antibiotics.

Fig. 1, A shows an 18-year-old right-handed high school student who was involved in a motor vehicle accident in which he sustained open fractures of the middle phalanx to the ring finger with extensor tendon laceration. There was an associated nail bed injury with open fracture of the distal phalanx of the small finger.

Fig. 1, B shows the x-ray films before and after intraosseous wire stabilization of the fracture. He was included in the group not receiving antibiotics, and his

Table I

Fracture location phalanx	Antibiotics	
	Yes	No
Distal	31	37
Middle	4	4
Proximal	10	5

fracture healed primarily. His range of motion is shown in Figs. 1, C and D at 3 months after injury.

Fig. 2, A shows a 25-year-old man who sustained an amputation of the long and ring finger at the distal phalangeal level in an industrial press. His wounds were irrigated and debrided in the emergency room and allowed to granulate; he was placed into the group not receiving antibiotics. Fig. 2, B shows the wound at 3 weeks, and Fig. 2, C shows a healed wound at 1 year, with mild hook nail deformity. The patient has returned to work without pain or restriction.

Results

A total of eight patients, four from the treated and four from the untreated group had development of clin-

ical signs of infection, such as drainage or throbbing pain that were not relieved by elevation of the extremity and oral analgesics. In each of these patients the onset of symptoms was in the second postoperative week. Antibiotics that had been previously used were re-started. A cephalosporin was started in the four patients who were previously untreated. Within the group of eight patients, there were four (two from each group) in whom purulent drainage developed and cultures were taken. Cultures of the purulent drainage from the antibiotic-treated group grew *Staphylococcus aureus*, and the two cultures from the previously untreated group were negative. Oral cephalosporins were used exclusively in this group of eight patients.

There were no patients in either group who required secondary surgical procedures, and no cases of osteomyelitis. Only 8.4% (8 of 91) of all patients had clinical signs of infection and 2.1% (2 of 91) had cultures that grew *Staphylococcus aureus*. The clinically-infected fingers accounted for 4.2% (4 of 91) of both the antibiotic-treated group and the nonantibiotic treated group.

Discussion

The majority of studies regarding the early treatment of open fractures with antibiotics have been in fractures of the long bones. Treatment recommendation ranges from a first-generation cephalosporin to a combination of cephalosporin and aminoglycoside depending on the severity of the injury, and whether or not gross contamination is present. These studies demonstrate a dramatic decrease in the incidence of infection with use of early antibiotics.

In the hand, the most important factor in the prevention of infection appears to be early aggressive local wound care. The use of antibiotics combined with appropriate cultures and aggressive local wound care is the best treatment for cases in which gross contamination is present with marginally viable tissue, such as in corn-picker injuries or high energy gunshot wounds. When used judiciously, antibiotics help increase limb survival and may improve secondary function of the extremity.

Although methods are different, this study supports the conclusion of Peacock et al.,¹⁵ that antibiotics should not be routinely used in the treatment of open finger fractures.

Conclusion

The early use of antibiotics in fractures of the phalanges that have been aggressively irrigated and debrided is of no benefit in the prevention of infections

when compared with a group of patients treated with aggressive irrigation and debridement alone. There was no difference in the incidence of infection from the proximal, middle, or distal phalanges, and in this small series there was no difference in the incidence of infection when Kirschner wires were used for internal fixation. Early treatment with antibiotics may play a role in helping prevent infections of the fingers in patients who have significant amounts of devitalized tissue or who are noncompliant in follow-up care.

The authors acknowledge Phyllis Kuhn, PhD, and Diane Voelker, Research Department, Hamot Medical Center for editing and typing this manuscript.

REFERENCES

1. Patzakis MJ, Harvey JP, Ivler D. The role of antibiotics in the management of open fractures. *J Bone Joint Surg* 1974;56A:532-41.
2. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand twenty-five open fractures of long bones. *J Bone Joint Surg* 1976;58A:453-8.
3. Burkhalter WE, Butler B, Metz W, Omer G. Experiences with delayed primary closure of war wounds of the hand in Viet Nam. *J Bone Joint Surg* 1968;50A:945-54.
4. Cooney WP, Fitzgerald RH Jr, Dobyns JH, Washington JA. Quantitative wound cultures in upper extremity trauma. *J Trauma* 1982;22(2):112-7.
5. Grossman JA, Adams JP, Kunec J. Prophylactic antibiotics in simple hand lacerations. *JAMA* 1981; 245(10): 1055-6.
6. Thirlby RC, Blair AJ, Thal ER. The value of prophylactic antibiotics for simple lacerations. *Surg Gynecol Obstet* 1983;156(2):212-6.
7. Wavak P. The use of antibiotics in acute hand injuries. *Orthop Review* 1981;(5):141-3.
8. Lister G. *The hand: diagnoses and indications*. Edinburgh: Churchill Livingstone, 1977.
9. Buck-Gramcko D. *Hand trauma: a practical guide*. New York: Thieme Inc., 1986.
10. Beasley RW. *Hand injuries*. Philadelphia: WB Saunders, 1981.
11. Flatt A. *The care of minor hand injuries*. 4th ed. St. Louis: The CV Mosby Co., 1979.
12. Green DP, ed. *Operative hand surgery*. 2nd ed., New York: Churchill Livingstone, 1988.
13. Coyle Leddy. *Injuries of the distal finger. Primary care*. Stover CN, ed. Philadelphia: WB Saunders, 1980:245-58.
14. Sloan JP, Dove AF, Maheson M, Cope AN, Wicks KR. Antibiotics in open fracture of the distal phalanx? *J HAND SURG* 1987;12(1):123-4.
15. Peacock KC, Hanna DP, Kirkpatrick K, Breidenbach WC, Lister GD, Firrell J. Efficacy of perioperative cefamandole with postoperative cephalixin in the primary outpatient treatment of open wounds of the hand. *J HAND SURG* 1988;13A(6):960-4.