



# ***Common Hand Injuries and Infections***

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***A Practical Approach to  
Early Treatment***

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*for*  
Susie, Rich, and Ben,  
*my perfect 36-degree triangle*

IN MEMORIUM



**Charles F. Gregory, M.D.**  
1919–1976

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# MEMORIAL PAGE

Charles F. Gregory, M.D., was one of America's greatest orthopedic educators. Professor and Chairman of the Orthopaedic Surgery Division of the University of Texas Southwestern Medical School from 1956 until his death in 1976, he was President of the American Orthopaedic Association, the American Board of Orthopaedic Surgery, and National Association of Orthopaedic Chairmen. His goal and objectives were and continue to be a special trust for those of us fortunate enough to be trained by him.

## GOAL

A good man, a sound physician and a skilled specialist in dealing with patients having problems in their musculoskeletal system.

## OBJECTIVES TO REACH THIS GOAL

1. The nurture of a medical conscience. . . . The patient trusts; the surgeon should not abuse that trust.
2. An inculcation of respect for the heritage of medicine and of orthopedics specifically.
3. To arrange for the acquisition of all essential information. No man knows it all. There is a variety of methods.
4. The development of skills (psycho, motor, operating, etc.).
5. To bring all of the above together in a process of delineating musculoskeletal problems and devising reasonable methods for their solution—in short—to learn to think and act in terms of orthopedic diagnosis and treatment.
6. Through pursuit of current developments, to aggrandize his fund of information, retain what is good, rescind what is obsolete and to constantly refresh and sharpen his skills.

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## PREFACE

The hand injury patient's first encounter with the physician most often determines the final outcome of the treatment. It is the "front line" physician (emergency room physician, family practitioner, or industrial medicine physician) who, in my opinion, has the most difficult task. I very much respect the talents of these men and women who are the primary care physicians. They do not have the comfortable niche we "specialists" enjoy. They must manage it all. Patients with hand injuries account for a major part of their important work. A recent study estimates that 10 million injuries to the hand and upper limb occur in the United States every year.

The purpose of this book is simple and straightforward: to improve the initial care of hand patients by providing these primary care physicians with a reference book that will function as a manual in the Emergency Department setting. Our orthopedic, general surgery, and plastic surgery residents have found this material a good place to start learning about the hand during their first year of residency. The book is directed toward medical students, emergency physicians, family practitioners, and industrial medicine physicians, and assumes little previous knowledge of the musculoskeletal system of the hand. I have tried to keep in mind what it would be like for me trying to interpret an electrocardiogram in the Emergency Department.

Those who practice the regional specialty of surgery of the hand tend to forget our own constrained and rather fragile base. It is easy to criticize the primary care physician for his abilities in our own delightfully small and limited area of expertise. But could I read an EKG? Could I manage a severe cardiac arrhythmia? Could I manage a multiply injured trauma patient? Without good reference material, I doubt it. Hand surgeons must help our colleagues who are primary care physicians. What is at stake here is 10 million injured upper limbs per year. There is no place for condescension. We must rely on the first physician who sees the patient, for as Bunnell said, "He most influences the final result."

In most specialty areas, there is a tendency to concentrate education and writing at sophisticated, detailed levels. Less emphasis has been placed on presenting the basic material in a quality form so as to really help the primary

care physician manage the initial care of his patients. This is, on reflection, paradoxical, since most hand patients are not initially seen by a hand surgeon.

It is also paradoxical that medical schools, while extolling the importance of primary care to their students, usually devote more time to lupus erythematosus than to hand injuries. Often the medical student receives no training whatsoever in hand or upper limb problems; yet in the United States 10 million patients per year consult physicians for these maladies. Six million patients visit Emergency Departments each year. Not to expose medical students to at least rudimentary training in hand injuries and infections is inconceivable. I hope that this book will provide an organized, quality resource for department chairmen in orthopedics and plastic and general surgery so that they can insist that this deficiency of the medical school curriculum be corrected.

Throughout the text, the title hand surgeon frequently is used. Who is he? Since as yet there is no real certification for hand surgeons, this question is moot. I think at the present time it is appropriate for the primary care physician to use his own judgment in selecting the particular person to whom he refers the more complex problems requiring special surgery or prolonged, detailed follow-up care. By and large, he knows who the "hand surgeon" is in his area.

Since the material presented here is so basic, most if not all of it did not originate with me. One of the sources has been our orthopedic residents in Dallas, who have often taught me either ways to do or ways to teach hand surgery. For several years, I have been fortunate enough to present much of this material at the American College of Emergency Physicians' postgraduate seminars. Frequently, I have gleaned pearls from these experienced and attentive students. Often, I have made judgments as to what treatment method to select when there is controversy. In order to keep the length of this book within usable limits, I omitted tricky and less predictable methods of treatment. I have followed the advice of my late Chief of Orthopedics, Dr. Charles F. Gregory: "Reasonable solutions for musculoskeletal problems." My other two teachers, Richard G. Eaton, M.D., and J. William Littler, M.D., have also influenced my thinking greatly. I am indebted to Dr. Eaton for imparting a practical approach to hand problems. Dr. Littler, seven years ago, suggested that I write such a manual as this, and the words "topographical anticipation" are his. The approach to the care of patients with hand problems that these two men taught me has been a guidepost for my teaching and practicing, and I hope that it is reflected in this book.

I have found that the anatomy of the hand often intimidates other physicians who are not hand surgeons, and therefore considerable effort went into trying to present anatomy in a way that is easy to use on a reference basis. The anatomy chapter presents topographical and regional levels of anatomy. A full color atlas was felt necessary to provide a ready reference source for the physician faced with not knowing the topographical anatomy required to make an intelligent decision about which structures are at risk.

The medical illustration firm of Jones, Pointer, Winn, Inc., and particularly Mr. Russell Jones and Mr. William Winn, deserve a special note of thanks. The talents of these two men are obvious from their work in the text, but the real enthusiasm they continued to display over the many months that we worked together is not so obvious. We worked as a team, and revising a

drawing until it was just the way I wanted it was never a problem. They are skilled professionals, leaders in their field, and have dedicated themselves to outstanding medical illustration.

Mrs. Kathleen Rhea has spent many hours typing and retyping the manuscript in addition to performing her daily duties of office nurse and transcriptionist in a busy office practice. Her efficiency and "can do" attitude make her a very special person.

I would like to thank the W. B. Saunders Company for their generous support and for their confidence in this project, especially the medical editor, Mr. Carroll Cann. He made my first publishing experience a fascinating and enjoyable one. Don Abbott also helped in the initial stages.

My wife, Susie, was both critic and motivator and spent many hours listening to or reading the text. My sons, Rich and Ben, gave up many weekends and evenings when Dad tried to find time between a busy hand surgery practice and their activities to work on "The Book."

Finally, there is a place for more reason in our selection of solutions to all patients' problems. Hand injuries are no exception. I hope that the material presented in this text reflects this. In a time of exploding medical costs, we threaten our country with bankruptcy because of our patients' insatiable desire for the "best" in health care. We as physicians must always ask the question, "Is this a reasonable solution to this patient's problem?" Just because we have been to the moon does not mean that we must go there every weekend! To be sure, there is no pat answer for this problem, and there needn't be as long as physicians continue to be in charge of the treatment method selected. I feel assured that the trust our patients have placed in us to make this difficult decision will continue to be ours so long as we ask ourselves the question, "Is it reasonable?"

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## 1

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## FOUNDATIONS OF GOOD HAND CARE

### Hand Injuries—An Important Health Problem

In the United States, twelve million patients a year visit physicians, emergency rooms, and doctors' offices because of upper limb injuries.<sup>1</sup> The potential impact on their lives and jobs and on the economy of the nation is significant and, until recently, for the most part has been overlooked. Earlier and more accurate diagnosis in the emergency room is leading to better care with more rapid and complete restoration of these patients to productive, fulfilling, and happier lives.

The emergency room care of hand injuries is a major health problem. About six million patients are seen yearly in emergency rooms for disorders of the upper limb.\* Whether or not physicians have a primary interest in the hand and its injuries, those who care for patients in the emergency room face this problem daily. In fact, the hand and upper limb may be the most commonly injured part of the body, accounting for nearly one third of all injuries.\* Although many are not severe, all require a decision to be made by the physician in attendance. There are not enough hand surgeons trained to attend each of these patients. This is appropriate, since by far the majority can be cared for by physicians with a basic knowledge of the anatomy and physiology of the hand. Even the patients with more complex injuries must first be identified by the primary physician before an appropriate referral can be made.

In addition, the patient should be informed that the initial exam is incomplete without a follow-up evaluation in the office a few days later. In

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\*Jennifer L. Kelsey, et al.: Upper Extremity Disorders: A Survey of Their Frequency and Cost in the United States. Yale University School of Medicine, Department of Epidemiology and Public Health (St. Louis: C. V. Mosby Co., 1980).

the less hectic environment of the physician's office, the patient is less agitated and better able to cooperate with the examiner. Even though hand injuries are not life threatening, they do require follow-up care.

## Topographical Anticipation—A Philosophy

In hand injuries, **topographical anticipation** is the key to accurate diagnosis. Just as “chance favors the prepared mind,” during an examination you are much more likely to identify the precise nature of the injury if you organize your thought process topographically into three steps. First, carefully determine the *precise* site of injury. Second, correlate this with the topographical anatomy—what structure could be cut? Third, test for that injury specifically. Don't be embarrassed to use the anatomy atlas of this book often. Even the best physician or surgeon often needs to refer to an atlas, unless he is a hand surgeon working continuously and exclusively in this anatomical region.

Too often a cursory examination is done without the mental discipline required for precise identification of injured structures. The time-honored but inadequate phrase, “He can move his fingers and says he can feel,” has led to all too many misdiagnoses. Problem solving in hand injuries, using hand and head to perform a careful exam, brings out the Sherlock Holmes in all of us (Fig. 1–1). With the patient's history, the clues in the exam are often uncovered with tools no more complicated than a paper clip!



## TOPOGRAPHICAL ANTICIPATION

FIGURE 1–1. **Topographical Anticipation.** Accurate diagnosis of hand injuries depends on a knowledge of topographical anatomy and a disciplined thought process rather than lab tests and specialized instruments.

## Wound Care

The importance of proper wound care needs emphasis in today's "modern antibiotic era." Rather than an "antibiotic" approach, a "biotic" or biological approach to wound care is essential. After all, at best we can only direct and assist the body's own mechanism for wound healing. Too often we forget the lessons of our predecessors who instructed us to cleanse the wound carefully. There are at least four major considerations in wound care: (1) dilution of the inoculum; (2) débridement—gentle, limited removal of nonviable tissues; (3) "to close or not to close"; and (4) resting the injured part.

**1. Dilution of the Inoculum.** All open hand injuries should be considered contaminated. Frequently there is massive chemical as well as bacteriological seeding from the working man's hand at the time of injury. *The primary concern in early hand care is the prevention of infection.* The carefully performed five- to ten-minute surgical scrub should be part of the management of even the most trivial of hand wounds. A resident once summed up this point well by saying, "The solution to pollution is dilution" (Fig. 1–2). Simply soaking the hand in a soap solution, which may be a time-honored tradition in most emergency rooms, is not adequate and may actually be deleterious, owing to maceration of the skin. In addition, prolonged contact of delicate structures such as joint cartilage and tendon with the strong bactericidal soaps has been shown to cause cell necrosis. Following the scrub of intact skin, copious sterile saline lavage under pressure has been shown to decrease bacterial count and to lead to lower wound infection rates.

**2. Débridement.** Although the sharp excision of nonprofused, crushed, or contaminated tissue is an essential part of the primary care of open upper limb injuries, it must not be as ruthless as in lower extremity wounds. Proper instruments must be available for this frequently tedious and time-consuming task. Surgical débridement must be meticulous and is frequently the only way



FIGURE 1–2. **Wound Care.** Copious high-pressure sterile saline lavage reduces the bacterial inoculum and is an important principal of wound care.



FIGURE 1-3. **Débridement.** Meticulous mechanical cleansing of foreign debris and gentle minimal removal of nonviable soft tissue should be done in all open hand injuries.

that paint, grease, or soil can be adequately removed from hand wounds (Fig. 1-3). In massively contaminated or devitalized wounds, this should be done in an operating room setting. It may often need to be repeated on more than one visit to the operating room in massively contaminated wounds.

**3. Wound Closure.** A useful clinical rule is that no traumatic wound should be primarily closed unless, in the surgeon's mind, it has been converted to a wound that is very nearly identical to an elective surgical incision. Contrary to older teachings, hand wounds may also be left open when contamination is excessive. A distinction must be made here between the tight closure of a wound and providing coverage of certain particularly vulnerable delicate tissues. Cartilage and tendon are such tissues and must be protected from desiccation. Frequently, a single strategically placed suture

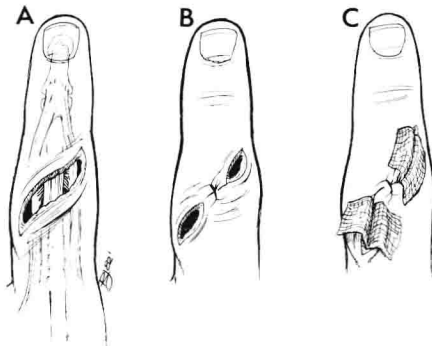


FIGURE 1-4. **Coverage.** Wound coverage is not the same as wound closure. The fragile tissues of the hand, such as bone, cartilage, tendon, and nerve, can be protected from desiccation by loose coverage of the wound and yet still allow satisfactory drainage if a few carefully selected sutures are used.

will accomplish this without actually closing the wound. Other tissue in the wound can be left open (Fig. 1–4). There is an all too common misconception that hand wounds demand a tight wound closure with miniature 6-0 nylon sutures spaced at 1.0-mm (or less) intervals. This is simply not true. Although careful and accurate tissue approximation is important, this is best accomplished with more widely spaced sutures carefully placed to encourage eversion of the wound edges. Interrupted vertical mattress sutures of 5-0 or 6-0 nylon are useful in this regard. The wound should be left widely open when the risk of infection is great (as in animal bites, human bites, and lawn mower injuries) or when swelling due to crush injury is expected. The late appearance of the scar of wounds left open in the hand is almost always cosmetically acceptable, but in the event that scarring is a problem, this can be dealt with at a later date when less risk of loss of tissue due to tight closure or infection is present.

**4. Resting Injured Tissues.** Many novice surgeons neglect to immobilize the injured hand, thinking either that stiffness can be avoided by immediate motion from the day of injury or that it will be less convenient for the patient to immobilize the hand properly. Neither of these is the case. Complete rest for 10 to 14 days is necessary for the healing scar to develop adequate strength to resist separation of the wound. The hand is a unique organ and use of these tissues will be attempted by the patient if he is allowed to move. Sutures should not be removed in three days, as they are in the face, but need to stay in at least ten days and may be left in safely for as long as three to four weeks if nylon or wire suture material is selected. A plaster dressing will usually facilitate healing and help the patient keep the dressing and wound clean and intact. Details of this dressing are so important that a separate chapter has been relegated to its construction (see Chapter 4).

## Use of the Tourniquet

Hand injuries can be more safely and quickly managed by the use of a pneumatic tourniquet placed high on the arm near the axilla. Bunnell once said, "Operating on the hand without a tourniquet is like repairing a watch in an ink well." Pressure should be 275 mm to 300 mm of mercury. Commercially available tourniquets are convenient but not mandatory. A blood pressure cuff taped and augmented with a Péan clamp works well (Fig. 1–5).

Patients tolerate the tourniquet well for 10 to 20 minutes at a time, particularly if excess venous blood has been removed by elevation or exsanguination with a sterile elastic bandage prior to applying the pressure of the tourniquet.

Rubber band tourniquets and Penrose drains are not any more convenient to use than the pneumatic tourniquet method described above and may lead to damage of the arterial intima due to the pressure developed over a small surface area. Rarely, but tragically, fingers have become gangrenous in some of these patients. The pneumatic arm cuff is preferred, and if the pressure is less than 300 mm of mercury, it is virtually harmless if not left on for more than 30 minutes at a time. This is usually adequate for most emergency room procedures, and the tourniquet may be reinflated after a 5-minute deflation period if additional time in the bloodless field is necessary.

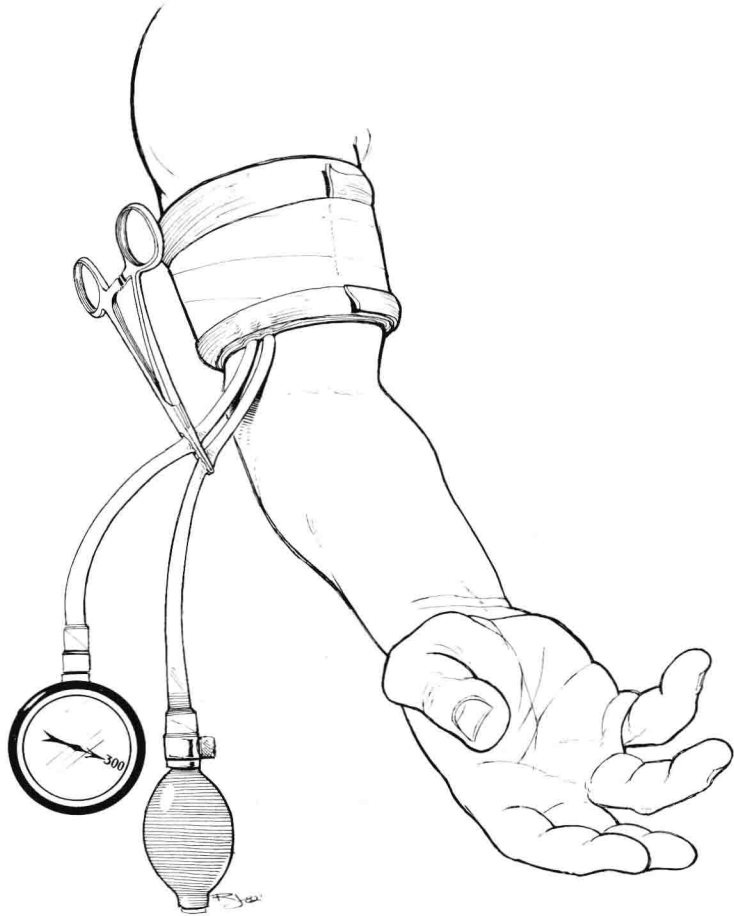


FIGURE 1-5. **Blood Pressure Cuff Tourniquet.** Sterling Bunnell said that “operating on a hand without a tourniquet is like repairing a watch in an ink well.”

## X-ray Examination

All too often an inadequate x-ray examination is made in hand injury patients. The standard two views of the hand usually wind up being an anteroposterior (AP) and oblique of the hand and part of the wrist (Fig. 1-6A and B). This is rarely adequate. At a minimum, a precise AP view and a precise lateral view of the exact area that is injured are necessary. Occasionally special views, such as oblique views or carpal tunnel views, and even tomography, may be necessary to demonstrate a fracture. The physician should be sure that the x-ray he examines is adequate. If it is not, the physician should insist that others be made.

**X-rays of the Fingers and Thumb.** A simple method for obtaining a true AP and lateral of the digits is to use the *finger nail as a landmark*. When the true AP and lateral x-ray of the fingernail is made, a true AP and lateral of the bones is also made. One can verify this by checking the x-ray to see if the condyles of the interphalangeal (IP) joints are superimposed (Fig. 1-7A and B).



FIGURE 1-6A and B. **The Classic Emergency Room Film—"Two Views of the Hand."** This film is frequently inadequate, particularly in digital injuries. Always obtain at least a true AP and true lateral of the part involved.

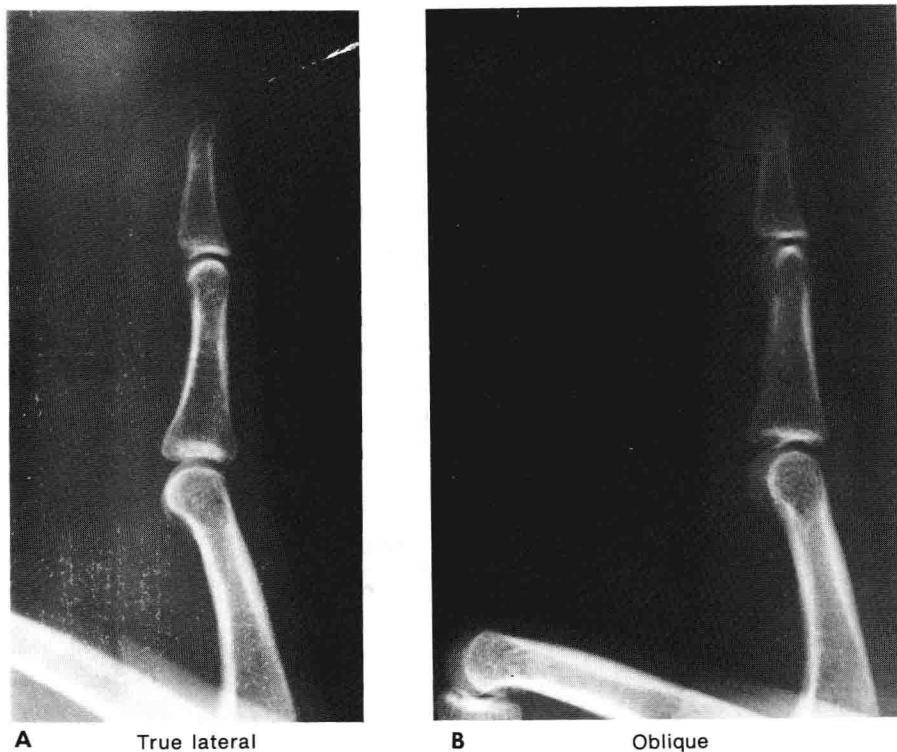


FIGURE 1-7A and B. **Use the Fingernail as a Landmark.** The fingernail is a perfect external landmark for obtaining a true lateral of the bone of the digit. If a true lateral x-ray of the fingernail is obtained, a true lateral x-ray of the underlying bones is sure to follow.