



# **Practical Hand Surgery**

**Edited by**

**Norman J. Cowen, M.D.**



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## Preface

Despite the recent appearance of a myriad of books on various aspects of hand surgery, no single text has appeared which can serve as a basic "first book" to introduce the reader to this relatively new specialty. This volume is designed to answer this need. It deals with the more important aspects of hand surgery in a very readable manner without going into excessive detail. The authors have stressed basic principles and expanded their topic in proportion to its importance. More advanced material is contained in the two panel discussions and in the section entitled "Annual Washington Review Course in Hand Surgery." The anatomy is discussed in individual papers as needed. A few papers have been included to acquaint the reader with interesting recent developments and some areas under very active investigation.

As a basic text, it should provide sufficient general knowledge of hand surgery for medical students and residents who rotate through orthopedic and plastic surgical services. For orthopedic, plastic, general surgery and emergency room residents, it can be their "first book" to introduce the subject and to organize their thinking. As interest and time allow, these residents can read the classical references listed at the end of several papers, as well as more detailed texts. Residents preparing for board examinations should find the section on the Review Course very helpful.

Because it includes current trends and recent developments as well as basic principles, the text should be extremely useful to surgeons doing a modest amount of hand surgery who have had little recent formal training in this subspecialty.

Several papers are written with the occupational and physical therapist in mind. In general, the text should serve to make them familiar with the general principles and goals of the surgery which is performed on their patients. It should help them to be able to discuss various aspects of the surgery with these patients and thus to allay unnecessary fear, to give

encouragement and to reinforce the instructions of the physician. By understanding the goals of surgery, the experienced hand therapist may be able to recognize a patient with unrealistic expectations or one who does not understand the risks, complications or uncertainties of surgery and bring this to the attention of the patient's physician.

The general content and its manner of presentation should also make the book of value to emergency room personnel, operating room nurses and technicians, occupational and public health nurses, insurance adjusters, compensation commissioners and lawyers, and any other persons who have some contact with patients having hand problems. For this group of people, it should provide an understanding of the amount of preparation and care required not only by the surgeon but also by the patient himself in order to attain a good result.

The book has evolved from the Annual Georgetown Hand Symposium, which began in 1973. I have had the duty and honor of being the organizer and program director of this symposium since its inception. The book also serves as a basic text for those attending the symposium.

THE EDITOR

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# **Introductory Hand Surgery**



# Evaluation of the Injured Hand: Preoperative Preparation

John S. Gould, M.D.

## Objectives

1. To provide guidelines for the appropriate evaluation of hand injuries in the emergency department.
2. To discuss the basic elements of history taking and the rationale for obtaining this information from the patient with an injured hand.
3. To discuss the pertinent points of the physical examination of the injured hand and the rationale for the exam.
4. To discuss the types of injuries that occur, and to emphasize those which require urgent treatment and those which appear innocuous, but are severe.
5. To discuss immediate emergency department management of the injured patient, preoperative preparation and responsibilities of informing support personnel; and to discourage probing of wounds in a nonoptional environment.

A most important initial step in management of the patient with an injured hand is evaluation of the injury in the emergency department. It is incumbent upon the examiner to obtain essential information which will provide guidelines for surgical management initially and for subsequent reconstruction. It is critical that the physician obtain a full history of the circumstances of the injury and basic fundamental information concerning the patient's medical history and social circumstances. A thorough physical examination of the injured part is particularly helpful while the patient is responsive. The deter-

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mination of the urgency for surgical management is also an essential step. This implies an evaluation not only of the degree of contamination and the age of the wound, but also particularly the vascularity of the injured part. The time elapsed since the injury occurred should be determined in order to assess the urgency of the situation, as well as subsequent management in the operating room. Replantation of an amputated member is feasible up to 6 hours after amputation when the amputated part contains muscle; with cooling to 4 C, this time may be prolonged to about 12 hours. When muscle is not involved, replantation can be carried out at 12 hours after injury or even later. In fact, experimental studies have determined that with proper cooling, revascularization and replantation can be carried out up to 36 hours later. The environment in which the injury occurred should also be determined. For instance, a scalpel wound in the operating room would be the ideal type of injury, allowing immediate repair of all injured structures and primary closure. On the other hand, if the patient being operated had known hepatitis or syphilis, the problem would be complicated. Injuries occurring to garbage collectors on their route or to workers in a chicken processing plant are notorious for complications. Butchers or housewives who sustain injuries while cutting raw meat are felt to have grossly contaminated wounds. Injuries occurring in a lumber mill or from a cotton picker are often of the ripping and tearing type, with their own special management problems. A laceration occurring in a river or in the ocean may be complicated by rare and unusual organisms. Injuries occurring in the home may or may not provide unusual sources of contamination.

### Type of Injury

Various types of injuries to the hand may occur; some require only simple management and others cause such extensive damage that the surgeon must be aware of the type of injury to provide adequate treatment. Types of injuries include clean or ragged lacerations, local or diffuse crushing injuries, and complete or incomplete amputations. When a diffuse crush occurs, reconstruction will be complicated, requiring grafting of blood vessels, tendons, nerves and bone, as well as skin.

Avulsion injuries, particularly ring avulsions, create damage to blood vessels and nerves which is often irreparable. Even vascular replantation may not be able to retrieve injuries of this type, although the advent of vein grafting has made it possible to provide survival and, on some occasions, reasonable function. Penetrating wounds have to be differentiated between high- and low-velocity types. The wound produced by a standard low-velocity missile at close range may well qualify as a high-velocity injury. When this occurs, damage is usually far more extensive than the local wound. Jet gun injuries with various hydrocarbons and other fat solvents, grease and hot plastic cause initially innocuous-appearing wounds, but the knowledge that the injury was inflicted by a jet gun alerts the surgeon to extensive damage requiring open management and frequent debridement. Burns vary from surface injuries in the thermal burn to extensive involvement in the electrical injury. Cold injuries must be thoroughly evaluated and managed, as is the case in a variety of envenomizations. Bites range from innocuous to lethal, although the initial injury may appear relatively benign. Awareness of the various toxins inflicted in these injuries is essential for appropriate management.

### Social History

The patient's age is an important factor, as is his general health. Young, healthy individuals may be able to tolerate extensive reconstructive procedures as well as extensive early management, including replantation. Older patients with a history of diabetes or other forms of vascular impairment are often poor candidates for vascular reconstruction. Patients with bleeding tendencies are poor candidates for anticoagulation.

The patient's educational level and occupation also require consideration. For a manual laborer, amputation of a digit may be considered a "badge of courage," and replantation may require too extensive a loss of work time to be feasible. In contrast, the loss of a thumb or hand in such an individual may destroy his ability to provide a livelihood for himself and his family. In the case of a musician, for instance, for whom preservation of the digits is essential, a more extensive attempt may be made to save a part.



## Physical Examination

The examining physician should thoroughly evaluate each anatomic structure of the hand. Crush injuries which appear to have caused only a skin laceration may be retrievable with revascularization, but if only the skin is sutured and the digit is not properly evaluated, the digit may be lost. Evaluation includes more than just examination of the skin and the appearance on routine x-ray films of the injured part. Not only must the skin be evaluated for its vascularity, but thorough examination should also be done for the extensor and flexor tendon mechanisms, the nerves, arteries, bones, joints and ligaments. Both flexor and extensor mechanisms need to be tested for individual functions. Each tendon function should be carefully evaluated, and the surgeon should avoid the error of being impressed by substitution maneuvers. To test an individual muscle, the part is placed in a position that its muscle tendon unit controls and the patient is asked to maintain that position against resistance. The examiner's other hand then palpates the activated tendon or muscle unit. If this function cannot be determined, then one must assume that the part has been injured. In patients who do not respond to an attempt to test these functions, the digital cascade and stance is helpful in diagnosing a lacerated tendon. The tenodesis effect, achieved by flexing and extending the metacarpophalangeal joint or the wrist, will help in determining whether the tendon is intact.

Both the sensory and motor nerves supplying an area need to be tested. A discrete examination is carried out, including the test for two-point discrimination. A patient may complain of decreased or lost feeling in an area and may have two-point discrimination or discrete sharp and dull discrimination, simply indicating a contused nerve or mild neurapraxia. The findings here are particularly helpful when examining a contused nerve. If there is no evidence of sensibility in that nerve, the surgeon should consider an epineurotomy, at least. If axonotmesis has occurred, then a repair should be carried out. One must also be aware of anomalous innervations and test autonomous areas. If there is a question, a nerve block can be carried out on the nerve that may be providing overlap.