



Hand Surgery: Improving Efficiency between the Surgeon and Surgical Technologist

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Efficiency in the operating room (OR) is centralized around the communication between the surgeon, surgical technologist, circulating OR nurse and anesthesia. All members of the OR team must understand the planned procedure to allow critical steps to be performed safely and to decrease operative time.

Though hand surgery is typically focused on the distal upper extremity, hand surgeons perform a wide variety of procedures with variable complexity in a single operative day. Knowledge and understanding of the range of hand surgeries is essential to anticipate the resources needed in the operating room with a varying case line-up. Surgical procedures range from a simple trigger finger release with minimal equipment to free flap reconstruction from the knee to the wrist. Additionally, hand surgeons routinely treat conditions for children as well. Still, there are fundamental principles of hand surgery that are shared by surgeons, but each surgeon may have a different approach to a similar surgical pathology and different procedures for the same diagnosis. This article details common principles of hand surgery operating room etiquette that are subject to modification based on operating team preferences and experience.

PRE-SURGERY CHECKLIST

A few keys to preparation for hand surgery procedures are understanding the anatomic location of the surgery, the need for bony

LEARNING OBJECTIVES

- ▲ Detail the procedural tips for hand procedures
- ▲ Examine the details of patient positioning and draping
- ▲ Evaluate where arthroscopic procedures are performed in hand surgery
- ▲ List which items are needed prior to the procedure
- ▲ Discuss ways the surgical team can increase efficiency when performing hand surgeries

fixation, and type of operative exposure. Addressing these aspects of a hand surgery will aid in minimizing equipment needs and improve operative flow.⁴ The anatomic location of the surgery is commonly described by radial, ulnar, dorsal, or volar aspect of a digit, palmar surface, or the wrist. In addition to dictating draping, the anatomic location will decide the type of tourniquet (digit or upper arm) to be used and if positioning adjuncts such as a Padgett hand table or lead hand will be needed. Though the hand or wrist is primary surgical site, the surgical team must discuss if other anatomic areas need to be surgically prepped into the field if a skin, nerve or bone graft is required. If arthroscopy is planned, the correct system will be needed and appropriate screen placement in the OR. A wrist arthroscopy will require a traction system which may sit on top of the hand table or clamp onto the OR bed and will likely require using finger traps. If the procedure is planned under monitored anesthesia care (MAC) or wide awake with local and no tourniquet (WALANT) instead of general anesthesia, the local anesthetic is administered in the pre-operative holding area.

Next, if the case requires bony fixation, it is important to know if the procedure will require percutaneous pinning with Kirschner wires (K-wires), require plates and screws or some other device. Some procedures may require multiple methods of bony fixation. The appropriate company representative will need to be contacted ensuring the correct implants are available. If bony work is planned, a large or mini C-arm must be requested from the radiology department and required drape collected. The use of fluoroscopy and radiation exposure in hand surgery has been studied extensively. The radiation exposure during hand surgery from the more commonly used mini-C arm is lower than a large C-arm.² Furthermore, radiation exposure from the mini-C arm during hand surgery without the use of lead protection significantly below the annual limits for whole body exposure, eye exposure, and hand exposure set by the National Council on Radiation Protection and Measurements.³ This risk is further reduced with the use of lead aprons, thyroid shields, and eye projection.^{2,3} The decision to use radiation-protective equipment should be considered



Figure 1: Applying Mini C-arm Drape over Limbs



Figure 2: Securing Mini C-arm Drape to Limbs

prior to each case. If more radiation protection is required, a mobile lead barrier should be requested for the OR.

Finally, the surgical exposure will guide patient positioning and types of skin and soft tissue retractors required for the procedure. For example, open reduction and internal fixation (ORIF) of a metacarpal uses very shallow retractors like a spring while a radial tunnel release needs much deeper retraction such as an Army-Navy. Other procedures such as nerve repair may require nerve allografts, conduits and microsurgical instruments.

The surgical team should meet to discuss these aspects of the upcoming cases to limit confusion regarding surgeon preferences during and between cases. Familiarity with these aspects of a hand surgery will allow a certified surgical technologist to assist in creation of case specific instrument trays to improve OR efficiency.⁴

POSITIONING, TOURNIQUET, AND LOCAL ANESTHETIC

Once in the room, the patient may either remain on the stretcher or be transferred to the operating room table. Currently, most hand surgery procedures can be performed on the stretcher with an easily removable slide-in hand table. Remaining on the stretcher allows it to be easily rotated 90 degrees, limits movement of the patient before and after the procedure and saves about 4 minutes of turnover time.^{4,5} If using a large C-arm, then the surgeon may prefer the patient be placed on the operating room table with a hand table attachment without a standing leg. This allows for complete mobility of the C-arm under the hand table.

Next, a tourniquet is placed on the upper extremity. Tourniquets come in multiple sizes with common sizes for adults being 18 inches and 24 inches. Soft roll is wrapped around the upper extremity at the planned area of tourniquet placement. The tourniquet is then applied, and the distal aspect of the tourniquet is secured with foam tape or a 1010 Steri-drape. A digit tourniquet may be used in certain cases.

If the procedure is under general anesthesia, local anesthetic will be given at the end of the case. Local anesthetic may not be required if the patient received a pre-operative regional anesthetic block.

DRAPING AND POSITIONING

After the patient is prepped according to surgeon preference, a medium sheet is placed on the hand table. A blue towel folded lengthwise into thirds is then wrapped around

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the upper extremity around the tourniquet and secured with a penetrating towel clip. If other areas of the body are required for adjunctive procedures, then these prepped areas are surrounded with sterile towels. Finally, an upper extremity drape is applied (with holes cut out over additional prepped areas if needed.) If a C-arm or mini-C arm is required, then it should be draped appropriately. Since the mini-C arm is more frequently used, learning to drape the mini-C arm is most useful to start. The two limbs of the mini-C arm are the X-Ray head, which typically has button controls, and the flat X-Ray detector plate. The mini-C arm drape will have two separate parts for each of the limbs. First, the mini-C arm should be either completely vertical or horizontal. The surgical technologist will then place a single hand into each part of the drape meant for the limbs. The drape can then be placed over each arm simultaneously. The end of the drape facing the main body of the mini-C arm can then be advanced with the help of the surgical nurse. The drape is then secured to the mini-C arm limbs using rubber bands or ties on the drape. The mini-C arm will then be placed as positioning and space allow with the screen facing the surgeon. See Figures 1 and 2 for reference.

Next, for exsanguination of the upper extremity, an Esmarch bandage is wrapped around the hand from distal to proximal until the level determined by the surgeon and the tourniquet is inflated to 250 mmHg or 100mmHg above the systolic blood pressure. The surgeon may instead elevate the hand for two minutes prior to inflating the tourniquet if the patient has traumatic fractures or there is concern for infection. If fracture management is planned, the appropriate K-wires for provisional fixation and/or plating system or other implants for definitive fixation should be



Figure 3: Operating Room Setup with Instrument Table

confirmed and on the sterile field. If arthroscopy equipment is part of the procedure, the appropriate camera should be set up and connected to mobile equipment and screen tower. (Arthroscopic procedures will be discussed in a separate section.) The primary instrument table should then be moved in line with the hand table to allow for ease of instrument passing and mini-C arm use (Figure 3 and 4).

PROCEDURAL TIPS

Though the procedural steps may be variable, there are commonalities between hand surgeries. Most outpatient procedures will start with the incision and soft tissue dissection over the surgical site. A tenotomy scissor is a preferred tool for dissection, and a beaver style blade is used to incise deeper structures. Small retractors such as Heiss, small Weitlaner, Senn, and Ragnell are commonly used to

maintain operative exposure. For improved visualization, the surgeons will often use surgical loupes to magnify the operative field between 2.5 and 4.0 times. Though the field appears enlarged, the surgeon's field of view is narrowed. The surgeon will be more sensitive to changes in their field of view. Safe passing of instruments is crucial since the surgeon will not be able to see the instrument placed into their hand. In some procedures requiring anastomosis of blood vessels or delicate nerve repair, a surgical microscope will be necessary and appropriate draping will be needed. When using a microscope, the surgeon will require a set of fine microsurgery instruments, micro-suture, and small surgical clips. If an arthroscopic or fracture plating system is being used, familiarity with the systems prior to the procedure is critical to avoid passing of incorrect instruments. When aiding in fracture fixation, the surgical technologist must confirm plate size, screw size and type (locking, non-locking, or rescue), and type of drill or screwdriver to be used. When passing a drill or K-wire driver, ensure the surgeon is ready to accept the instrument to avoid an inadvertent sharps injury. Care must be taken when passing small screws to avoid losing them in the surgical field. Implant representatives should be immediately available for any questions regarding company specific instrument adjuncts. Most procedures on the upper extremity will use polyglactin 910 suture for deep closure and nylon suture for skin closure. In addition to the surgeon's preferred dressings, splinting material should also be available. For prefabricated splints, timing is critical to have the splint ready at the appropriate time but not so early that it hardens or dries out prior to application.

ARTHROSCOPIC PROCEDURES

Within hand surgery, arthroscopic procedures are performed at the wrist to diagnose and treat several pathologies including carpal tunnel syndrome, ligament disruption, and wrist fractures. Endoscopic carpal tunnel release and diagnostic wrist arthroscopy are two common procedures in a general hand surgery practice today.

Endoscopic carpal tunnel release can be performed with a variety of different systems that each have a series of dilators and a hand piece incorporating a small blade and camera. Each part of the system is used in a specific order that maintains safety and efficiency for the surgical team. Once the endoscopic hand piece assembled and ready to be used, the surgeon will ask for the series of dilators

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to widen the initial incision made. Each dilator should not be removed until the next dilator is handed to the surgeon. Next, a scraping tool is used clear subcutaneous tissue from the field of view. Frequently, the camera will blur and require removal from the hand piece in order to use a special cleaning pad. Additionally, debris in the hand piece can be easily removed by placing the suction tubing over the most distal aspect of the hand piece. The endoscopic hand piece will then be used to visualize and incise the transverse carpal ligament.

Diagnostic wrist arthroscopy is performed to evaluate wrist pathology directly using several viewpoints without the morbidity of an open procedure. Special equipment for wrist arthroscopy includes a wrist tower, a 2.7 mm 30-degree angled arthroscope, and a 3 mm hook probe.¹ The surgeon's preferred wrist tower will be used to aid with distraction of the wrist for better visualization of structures. The wrist tower will be attached to the operating room bed or placed on the hand table. The wrist tower may be sterile or nonsterile but does routinely require assembly. Next, sterile finger traps are attached to the wrist tower. The patient's elbow will be flexed to 90 degrees, and the surgeon will place the patient's fingers in the finger traps for adequate traction. The surgeon will be positioned facing the dorsal aspect of the wrist with the video screen facing them at the foot of the bed. There are several "portals" the surgeon will use to visualize different anatomy of the wrist. Wrist arthroscopy is commonly performed by injecting saline into the wrist for internal visualization though some providers may not use any fluid. The saline is typically injected using an 18G needle. Next, a 15 blade is used for the incision to minimize risk to the deep structures and a hemostat is used to dilate the portal incision to allow entry of the arthroscope.¹ The surgeon will then progress through several different portal incisions depending on the wrist pathology.



Figure 4: Operating Room Setup with Mini-C arm

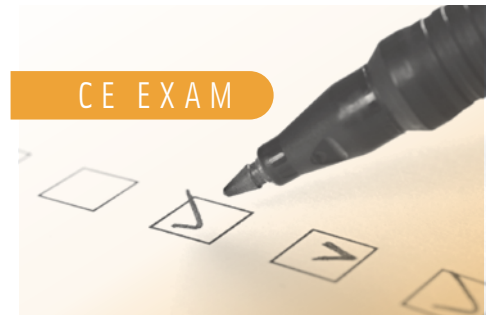
Hand surgery is often high volume and fast-paced and the surgical technologist is the hub of an efficient team. Whether it is the advanced preparation to have all the necessary equipment, familiarity with the procedure to anticipate the surgeon's needs or efficiently turning over the instruments and the room, the scrub is central to a successful enterprise.⁶

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1) **A case is planned for an open reduction and internal fixation of a distal radius fracture. Which of the following needs to be done pre-operatively?**

- a. Discuss with the surgeon regarding a preferred plating system
- b. Determine whether a large or mini-C arm is required for the case
- c. Discuss with OR staff if a product representative will be present
- d. All of the above

2) **When can local anesthetic be administered to the surgical site prior to prepping and draping?**

- a. Open reduction internal fixation of a metacarpal fracture
- b. Procedure under monitored anesthesia care
- c. Wrist arthroscopy
- d. Procedure under general anesthesia

3) **Which of the following is NOT a common soft tissue retractor in hand surgery?**

- a. Heiss
- b. Small Weitlaner
- c. Richardson
- d. Senn

4) **The primary instrument table should have which orientation with the operative hand table?**

- a. Perpendicular
- b. 60 degrees
- c. 45 degrees
- d. In-line

5) **Which of the following statement is false?**

- a. An Esmarch is used for all hand surgery cases.
- b. A common setting for tourniquet pressure is 250mmHg.
- c. Vicryl suture is commonly used to close deeper structures.
- d. Implant representatives should be available at the time of a procedure.

6) **What is an important consideration when a surgeon is using surgical loupes?**

- a. The surgeon's field of vision is widened.
- b. The loupes need to be sterilized before the procedure.
- c. The surgeon's field of vision is narrowed.
- d. The surgeon's field of vision is magnified 8.0X.

7) **Which is not typical equipment needed for diagnostic wrist arthroscopy?**

- a. A 2.7 mm arthroscope
- b. 3 mm hook probe
- c. Wrist tower
- d. Small Weitlander

8) **What is the correct sequence of instruments for an endoscopic carpal tunnel release?**

- a. Dilators, scraping tool, then endoscopic hand piece
- b. Scraping tool, dilators, then endoscopic hand piece
- c. Dilators, Heiss retractor, then endoscopic hand piece
- d. Scraping tool, Heiss retractor, then endoscopic hand piece

9) **What piece of equipment is used to keep the wrist in a vertical orientation?**

- a. Sterile bandage dressing
- b. Sterile rubber bands
- c. Unsterile finger traps
- d. Sterile finger traps

10) **During a diagnostic wrist arthroscopy, what fluid is injected into the wrist?**

- a. Fluorescent dye
- b. Methylene blue
- c. Saline
- d. Sterile water

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