



Basics of Elbow Arthroscopy Part II: Positioning and Diagnostic Arthroscopy in the Supine Position

Christopher L. Camp, M.D., Ryan M. Degen, M.D., Joshua S. Dines, M.D.,
Joaquin Sanchez-Sotelo, M.D., and David W. Altchek, M.D.

Abstract: The field of elbow arthroscopy has evolved significantly since the procedure was first introduced more than 30 years ago. As our knowledge and understanding grows, numerous technical modifications have been made to improve the safety and efficacy of elbow arthroscopy. One of the most significant modifications is the change from the supine hanging position to the supine-suspended position with the use of a mechanical arm holder. Currently, the supine-suspended and lateral decubitus positions are the 2 most commonly used techniques. In this work, we discuss the history of the supine position, provide key points for proper patient positioning, and detail the steps of diagnostic elbow arthroscopy. It is our hope that this work will serve as an up-to-date review and summary of the most critical components of this procedure for emerging elbow arthroscopists.

As our knowledge, experience, and technology advance, the rate and utility of elbow arthroscopy continues to climb at a rapid pace. Although initially used primarily for diagnostic purposes or loose body removal, the current indications for elbow arthroscopy are numerous.¹⁻³ Along with this growth, elbow arthroscopy techniques continue to be refined and improved compared with prior generations.⁴⁻⁷ Although a number of techniques have been described, the 2 most commonly used patient positions for elbow arthroscopy include the supine-suspended position and the lateral decubitus position.^{3,8} Both have their relative strengths and limitations, and key differences exist between the 2 techniques. In part II of this 3-part series on the basics of elbow arthroscopy, we will discuss the supine-

suspended technique. Part I focused on pertinent anatomy and portals, and further discussion of elbow arthroscopy for the patient in the lateral decubitus position is discussed in part III.

The initial description of the supine position was published in 1985.¹ In this technique, the patient's arm was positioned with the shoulder abducted to 90° and the elbow flexed 90°. This so-called standard supine position was subsequently modified to the supine-suspended position in which the patient remains supine but the arm is adducted across the body in a mechanical arm holder.⁴ The arm is positioned in space with the shoulder forward flexed 90°, internally rotated 90°, and the elbow flexed approximately 45°. This technique has numerous advantages compared with other positions; however, it is not without limitations (Table 1). In this work, we provide descriptive and video (Video 1) demonstration on how to properly position the patient and evaluate the anterior and posterior compartments during elbow arthroscopy in the supine-suspended position.

Technique

Operation Theater Setup

For elbow arthroscopy in the supine position, the operation theater must be properly organized and arranged before beginning the procedure. Standard elbow arthroscopy equipment will be required, including 4.0-mm arthroscope with a 30° viewing angle, standard arthroscopy tower, video monitor, and arthroscopic tools (shaver,

From the Department of Orthopedic Surgery, Mayo Clinic (C.L.C., J.S.S.), Rochester, Minnesota; and the Department of Orthopaedic Surgery, Sports Medicine and Shoulder Service, Hospital for Special Surgery (R.M.D., J.S.D., D.W.A.), New York, New York, U.S.A.

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Address correspondence to Christopher L. Camp, M.D., Department of Orthopaedic Surgery, Sports Medicine and Shoulder Service, Hospital for Special Surgery, 535 E. 70th St, New York, NY 10021, U.S.A. E-mail: campc@hss.edu

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Table 1. Comparison of Strengths and Limitations for Performing Elbow Arthroscopy in the Supine-Suspended Position Versus the Lateral Decubitus Position

Strengths	
Supine Position	Lateral Decubitus Position
Unobstructed access to the airway for anesthesia	Improved airway access compared with prone position
Gravity pulls anterior neurovascular structures away from the joint	Ready access to posterior elbow with anatomic orientation of structures
Allows arm to be freely positioned in space	Can easily be converted to open procedure posteriorly or laterally
Flexion and extension can be fixed without an assistant	Allows for free flexion and extension of elbow intraoperatively
Elbow can be removed from arm holder for easy conversion to open procedure if required	Elbow maintained in stable position Traction device not required
Limitations	
Supine Position	Lateral Decubitus Position
Requires mechanical traction device	Airway not as accessible as supine position
Some feel arthroscopic orientation is difficult to navigate without significant experience	If not properly positioned, anterior elbow access can be compromised
Posterior compartment access can be limited if elbow is flexed too much	Medial elbow may be more difficult to access for open surgical procedures
Arm may feel unstable if not positioned and secured properly	Slightly more difficult positioning of patient compared with supine technique

retractors, radiofrequency ablater, etc.). Inflow pressure can be maintained by a pump or gravity inflow. The surgeon will stand on the side of the operative elbow facing the patient, and the monitor should be positioned on the contralateral side facing the surgeon. A mechanical arm holder (such as the Spyder II; Smith & Nephew, Andover, MA) is positioned on the opposite side of the bed from the surgical side (left side of the bed when operating on the right elbow).

Patient Setup and Positioning

The patient is positioned on a standard operation theater table with the arm out on an arm board (Fig 1A). A nonsterile tourniquet can be applied and inflated during the case if desired. The arm is then prepped and draped in the usual sterile fashion. The bracket for the arm holder is applied to the patient's hand, wrist, and distal forearm and is tightly secured (Fig 1B). The mechanical arm holder is sterilely draped and brought across the patient's chest from the

opposite side. If open surgery is required, this can be performed with the arm on the arm board either before or after the arthroscopic portion of the case is completed. For the arthroscopic portion of the procedure, the arm is placed high across the chest into the arm holder. The shoulder is forward flexed so that the humerus is perpendicular to the floor. The shoulder is internally rotated, and the elbow flexed (Fig 1C). During the case, this allows for dynamic positioning with the elbow in flexion or extension as needed to relax the capsule and improve access to the anterior and posterior compartments respectively.

Accessing the Anterior Compartment

Before portal creation, the joint can be insufflated using sterile saline through the "soft spot" of the elbow. This area is easily palpated in the center of a triangle that connects the tip of the olecranon, lateral epicondyle, and radial head. Insufflation increases intra-articular working space and increases the distance between the joint and critical neurovascular structures.

The most common portals used to access the anterior compartment include the proximal anterolateral portal or midanterolateral portal from the lateral side (Fig 2A) or the proximal anteromedial portal or midanteromedial portal on the medial side. Accessing the joint from the proximal anterolateral portal allows excellent visualization of the anterior ulnohumeral joint (Fig 2B) and assessment of medial ulnar collateral ligament laxity as evidenced by ulnohumeral joint widening during the arthroscopic valgus stress test. In most cases, this portal is sufficient to allow visualization of the radiocapitellar joint (Fig 2C) as well. If the lateral side of the joint is not easily identified, or if a working portal is desired, a medial portal (either proximal anteromedial portal or midanteromedial portal) can be created under arthroscopic visualization and needle localization. Alternatively, many surgeons will choose to create a medial portal (such as the proximal anteromedial portal) as their first portal. Afterwards, a lateral portal (such as the proximal anterolateral portal or midanterolateral portal) can be created using a needle under arthroscopic visualization. Although both approaches are safe and reasonable, the surgeon should tailor the approach based on anticipated intra-articular pathology.

Accessing the Posterior Compartment

For the posterior compartment, the posterolateral portal (PLP) is the first portal created and is initially used for viewing (Fig 3A). Once views of the olecranon and olecranon fossa have been established, the direct posterior portal can be created through the tendinous portion of the triceps. This is generally used as a working portal for the posterior elbow. When viewing from the PLP, the lateral (Fig 3B) and medial (Fig 3C)

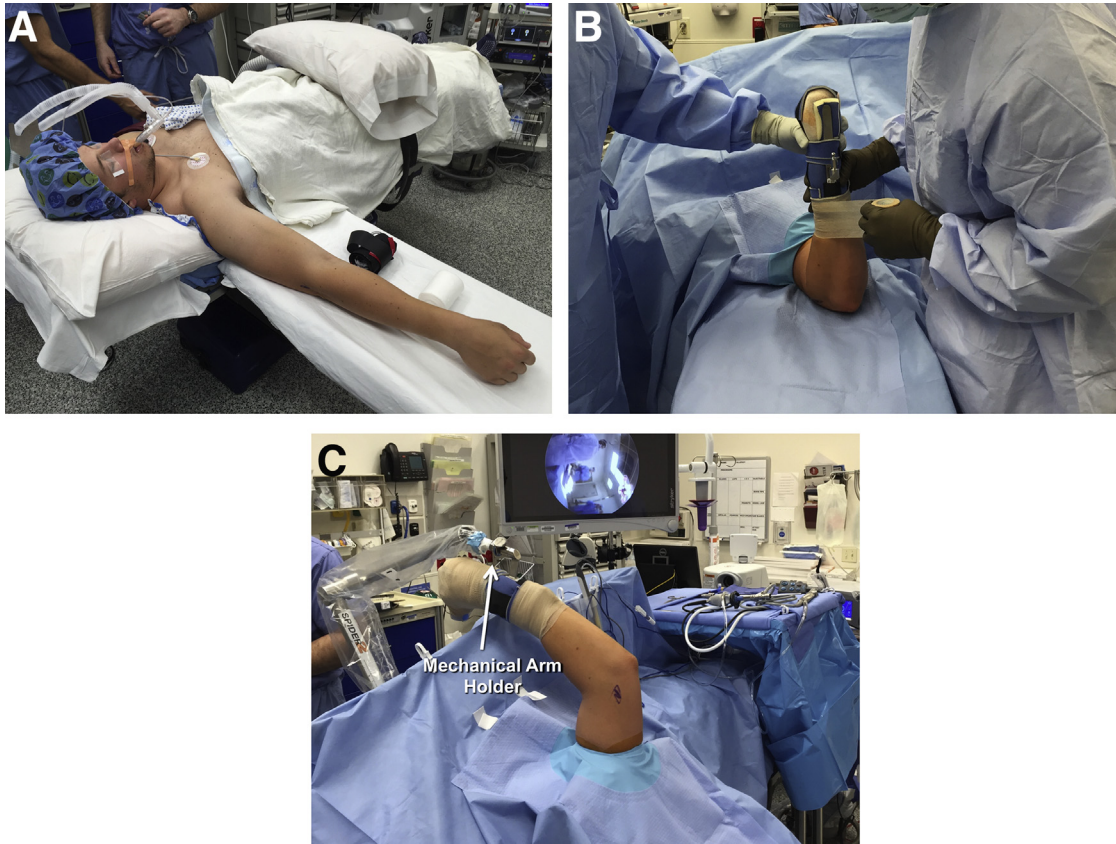


Fig 1. (A) Patient undergoing arthroscopy of the right elbow is positioned on the operation theater table with the right arm initially extended on an arm board. (B) The extremity is prepped and draped in the usual sterile fashion, and the bracket for the arm holder is secured and overwrapped to prevent the extremity from slipping during the case. (C) It is then fixed to the arm holder over the patient's chest with the humerus directed perpendicular to the floor.

gutters can generally be visualized without difficulty in nonarthritic patients. However, for patients with obesity or hypertrophic osteoarthropathy, the medial gutter can be difficult to visualize from the PLP. In these cases, the camera can be placed in the direct posterior portal for assessment of the medial side.

With the camera in the PLP and the direct posterior portal serving as a working portal, most pathology in the medial gutter, olecranon fossa, and lateral gutters can be addressed. If significant work in the lateral gutter or radiocapitellar joint is required, a direct lateral portal can be created in the soft spot of the elbow. This portal is created by needle localization. Needle insertion should be visualized arthroscopically to ensure that the portal provides sufficient access to the region of interest. If the elbow is hyperflexed, the majority of the capitellum can be reached from this portal while viewing from the PLP. In cases of very anterior capitellar injury, a distal ulnar portal can be created with the elbow hyperflexed. Placed just off the lateral border of the ulna, this portal pierces the anconeus and gives access to the anterior capitellum. It is useful for treating osteochondral injuries in this region.

Discussion

With improved arthroscopic equipment and surgical techniques, elbow arthroscopy is increasingly being used to treat elbow pathologies that were previously treated in an open fashion. After modification from its original description, elbow arthroscopy in the “supine-suspended” position has gained popularity.^{1,4} This position has a number of distinct benefits, including improved access to the airway, free and rigid positioning of the limb in space, gravity distraction of the anterior compartment, and easy conversion to open procedures on any side of the elbow (Table 1). Although some have raised concern over security of the arm in the arm holder, this has not been an issue in our practice. The use of newer arm holders and secure overwrapping of the arm bracket improve stability.

When compared with the lateral decubitus position, the supine position offers a number of distinct advantages (Table 1). These include optimal airway access, ease of positioning, improved access to the anterior compartment, and ready access to both sides for open procedures. In contrast, from the lateral decubitus position, access to the medial elbow for open procedures is

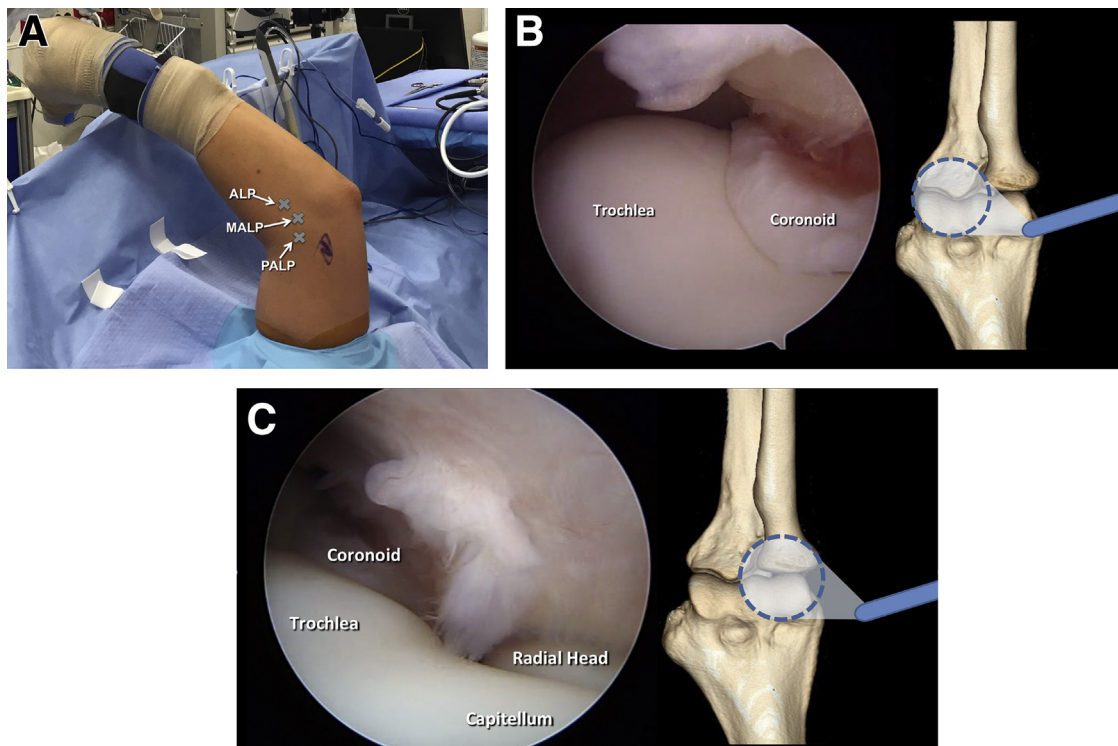


Fig 2. When the elbow is placed in the supine-suspended position for elbow arthroscopy, the standard anterior portals used to access the lateral side of this right elbow are easily visualized. The arm is secured across the patient's chest using a mechanical arm holder. (A) The standard lateral portals include the proximal anterolateral portal (PALP), midanterolateral portal (MALP), and the anterolateral portal (ALP). (B) When viewing from the PALP, the medial side of the anterior elbow is easily visualized. (C) By slightly withdrawing the camera, the remainder of the lateral side of the joint can be inspected.

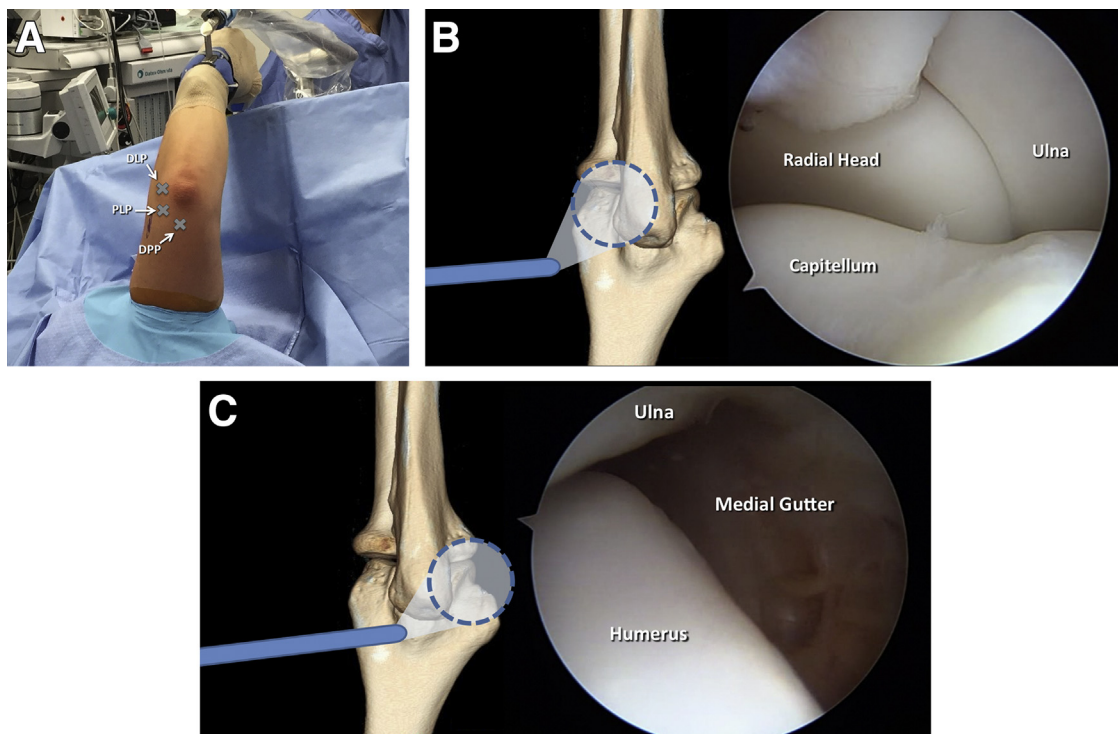


Fig 3. (A) When viewing this right elbow from the posterior side, the direct posterior portal (DPP), the proximal lateral portal (PLP), and the direct lateral portal (DLP) can easily be seen. (B) With the camera in the PLP, the lateral gutter, radiocapitellar, and radioulnar joints are visualized. (C) From the PLP, the medial gutter can also be inspected.

Table 2. Key Points for Performing Elbow Arthroscopy With the Patient in the Supine Position

Key Points
Position arm holder on the opposite side of the bed so that access to the elbow is not impeded
Ensure the humerus is perpendicular to the floor to provide ample room for elbow flexion and extension
Secure hand/forearm in arm holder to prevent slippage
Flex elbow to increase space in the anterior compartment and extend it to increase posterior compartment working space
If access to the anterior capitellum is desired, flex the elbow to deliver the capitellum from the radial head and create a direct lateral portal (DLP)

difficult and patient positioning is more involved. There are, however, a number of benefits to the lateral decubitus position, including dynamic flexion/extension of the elbow during surgery, anatomic orientation of the posterior compartment, and no need for a mechanical traction device. Ultimately, both techniques are reasonable approaches for the vast majority of elbow pathologies that can be treated arthroscopically, and the approach should be based on surgeon preference and experience.

In summary, a few key points to remember when performing elbow arthroscopy in the supine position include positioning of the arm holder on the contralateral side, proper positioning of the arm high over the chest, and altering the flexion/extension angle of the elbow to increase the working space or to uncover the capitellum from the radial head as needed (Table 2). When appropriate steps are followed, elbow

Table 3. Equipment Required for Elbow Arthroscopy in the Supine-Suspended Position

Equipment Required
Mechanical arm holder such as the Spyder II (Smith & Nephew)
Standard arthroscopy tower and equipment

arthroscopy can be performed in the supine position in a safe and efficient manner with minimal equipment required (Table 3).

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