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Operative Techniques in
Orthopaedics

Elbow Arthroscopy: Set Up, Portals, and Tools for Success

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Elbow arthroscopy is a safe and effective tool for the diagnosis and treatment of multiple intra and extra-articular elbow pathologies. However, the elbow's small size, complex three-dimensional anatomy, and proximity to neurovascular structures can make arthroscopic visualization and treatment technically demanding. Complications are uncommon, but include injury to superficial and deep nervous structures, infection, portal site drainage, and compartment syndrome. The safe performance of elbow arthroscopy requires not only an in-depth knowledge of superficial and intra-articular anatomy, but also proper technique. Attention to key set-up components, including, patient positioning, operative and nonoperative arm positioning, arthroscopic instrumentation, arthroscopic pump pressure, and portal placement can facilitate ease of visualization and allow for the prevention of iatrogenic complications. With the appropriate planning, foundation of knowledge, and meticulous surgical technique, elbow arthroscopy can be performed safely and efficiently for a wide range of elbow disorders.
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The elbow joint was initially described as "unsuitable for examination" because of small volume and proximity to neurovascular structures by Burman[1] in his classic 1931 article on arthroscopy. Routinely performed, arthroscopic visualization of the elbow joint has indeed proved to be a challenging task. The unique combination of complex three-dimensional anatomy, small working space, and the proximity of vital neurovascular structures limited the progression of elbow arthroscopy for almost 50 years after its initial description.[2] Fortunately, advances in arthroscopic techniques, coupled with an increased knowledge of local anatomy revitalized elbow arthroscopy as a viable treatment option in the early 1980s.[2,3] During its infancy, indications for elbow arthroscopy were narrow and described only for select intra-articular pathologies, including pain with normal radiographic and physical examination findings, loose bodies, synovectomy/synovial biopsy, lysis of adhesions, and osteochondritis dissecans lesions.[2-4] As elbow arthroscopy has evolved, these initial indications have been expanded to include complex intra-articular problems, such as elbow arthritis and contracture; extra-articular pathology, such as biceps tendon disorders and lateral epicondylitis; and fracture management.[4-7]

Although increasing experience and refinements in technique have simplified the performance of elbow arthroscopy, it remains a challenging procedure with a steep learning curve.[6] Special attention to elbow arthroscopic technique is required to avoid complications and improve results. The surgeon need not only a detailed knowledge of the working anatomy of the elbow, but should also strive for surgical efficiency as the constraints of tourniquet time and pericapsular edema can prove overwhelming in an already difficult to visualize joint. Safe and efficient elbow arthroscopy requires particular attention to patient positioning, as well as meticulous placement of arthroscopic portals. When elbow arthroscopy is performed in a systematic, meticulous fashion it can be a very effective tool for diagnosing and treating elbow pathology.

Anesthesia

A general anesthetic has been the preferred choice for many elbow arthroscopists as it allows for total muscle relaxation, variability in positioning, and protection of the patients airway. However, regional blocks have often been used in elbow

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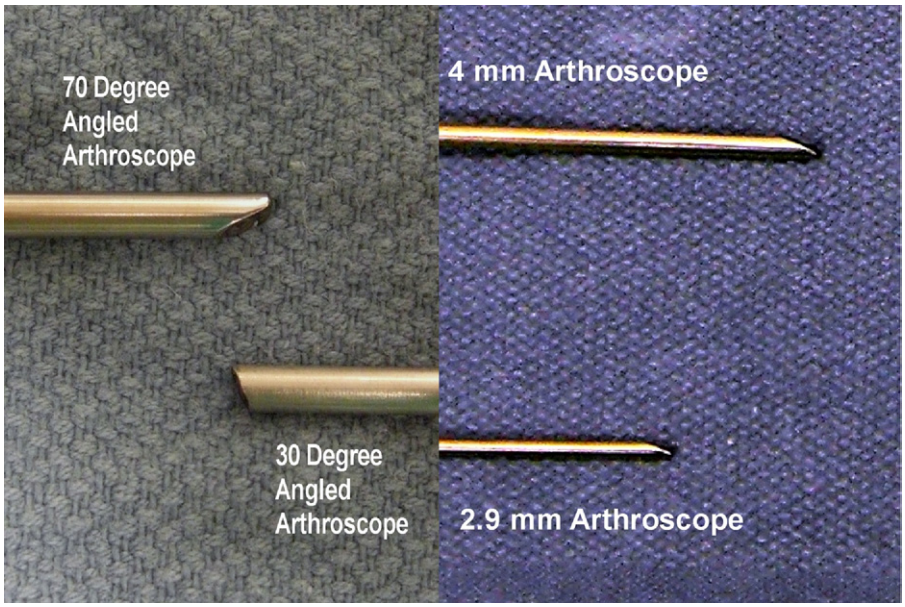

Figure 1 2.9 and 4.0-mm arthroscopes as well as 30 and 70 degree angled arthroscopes.

arthroscopy to alleviate post operative pain, decrease the need for inhaled anesthetics, and facilitate post operative range of motion.[8] Choices for a regional anesthesia, with or without intravenous sedation, include interscalene, Bier, and axillary blocks.

The choice between general and regional anesthesia can be influenced by several variables, including patient comorbidities, availability of regional anesthesia, postoperative rehabilitation protocol, and surgeon preference. The most frequently mentioned disadvantage of a regional anesthesia for elbow arthroscopy is the inability to obtain an accurate postoperative neurologic examination after the procedure.[9] Although nerve palsy or nerve transection after arthroscopy of the elbow is rare,[10] it can be catastrophic[11] and early identification could influence patient care and expectations.[10,11]

Recently, the use of regional blocks with indwelling catheterization has become a possibility to specifically address the earlier mentioned concern. With this technique, the patient has a catheter placed preoperatively and is dosed with a short-acting anesthetic before and during the procedure. In the postoperative holding area the infusion can be halted to obtain a detailed neurologic examination and then restarted to obtain pain control. The patient can either go home with a removable-catheter or have a long acting anesthetic injected before the catheter is removed in the postoperative area. This allows for the benefits of regional anesthesia and the surgeon an adequate postoperative examination.

Instrumentation

Arthroscope

Although the size and volume of the elbow is considerably smaller than that of other commonly visualized joints, the same basic instrumentation is used. A standard 4.0-mm arthroscope with a 30 degree angled lens routinely allows for full visualization of the joint. The surgeon should also have a 2.9-mm arthroscope as well as a 70 degree angled arthroscope in the event patient anatomy compromises visualization. It is common to switch to a smaller arthroscope when working in the posterolateral compartment (ie, posterior radiocapitellar space). Whether alternative size arthroscopes are used, it is important to use an interchangeable cannula system that allows passage of both the 2.9 and 4.0-mm scope through the same cannula. This will minimize the number of capsulotomies and facilitate passage of cameras between portals, decreasing the chance of iatrogenic neurovascular injury, and reducing the amount of fluid extravasation into the pericapsular soft tissue (Fig. 1).

Cannula/Trochar

Several features of the cannula system are important in elbow arthroscopy. Due to the small working space of the elbow, an unfenestrated cannula system should always be used to provide inflow into the joint, as the side portal of a fenestrated system has the possibility of being subcutaneous, whereas the primary inflow portal is intra-articular. If this occurs, then the side portal will extravasate fluid directly into the subcutaneous tissue, increasing pericapsular edema and the risk of compartment syndrome.[12] Also, the chosen trochar system should be conical and blunt ended as this poses lower risk to the neurovascular structures than sharp tipped trochars, whereas providing similar ease of entry into the joint thus decreasing the risk of articular cartilage damage in an already small working space (Fig. 2).

Pump System

The intracapsular pressure tolerated by the elbow joint before rupture can be as low as 30 mm Hg in compliant elbows[13] and may be significantly altered in stiff elbows.[14] To maintain distention of the joint, but minimize fluid extravasation, either a low-pressure pump system (<30 mm Hg) or gravity