Review of Poehling et al (1989) on elbow arthroscopy: a new technique

Nick F J Hilgersom,1,2 Rik J Molenaars,2 Michel P J van den Bekerom,3 Denise Eygendaal,1,4 Job N Doornberg5

ABSTRACT
This classic discusses the original publication ‘Elbow Arthroscopy: A New Technique’ by Poehling et al, published in 1989 in The Journal of Arthroscopic and Related Surgery on the introduction of the prone position and the proximal medial portal to elbow arthroscopy. The first attempt to perform elbow arthroscopy was on a cadaveric specimen by Burman in 1931, after which it took approximately 50 years until the first reports on the successful clinical use of elbow arthroscopy were published. By then patients were commonly placed in the supine position, wherein access to the posterior compartment was somewhat difficult, and entry to the anterior compartment of the elbow was commonly established using anteromedial and anterolateral portals, which were increasingly associated with nerve injury. In 1989, Poehling et al published on the successful clinical use of two new techniques: the prone position and the proximal medial portal. The proximal medial portal meant a first established safe and reproducible entry into the anterior compartment of the elbow that is still commonly used today. With these techniques, Poehling et al improved visualisation of the elbow joint and showed that elbow arthroscopy could be performed safely and reliably despite the closeness of neurovascular structures, transitioning elbow arthroscopy from being pioneer work into a safe surgical procedure that would become part of the common orthopaedic practice. This classic places the work of Poehling et al in a historic perspective, discusses its impact at the time and relates it to scientific developments up to the present day.

INTRODUCTION
Rationale for selecting this article
The first published attempt to perform arthroscopy of the elbow was in 1931 by Dr Burman, who concluded that the elbow joint was unsuitable for arthroscopy. In the 1970s and 1980s, several studies investigated the feasibility and usefulness of elbow arthroscopy, which led to a detailed description of the elbow joint anatomy and the description of several portals. Andrews and Carson were the first to describe a detailed set-up including commonly used portals: the anterolateral portal, the anteromedial portal and the posterolateral portal. Whereas accessing the posterior compartment using the posterolateral portal was relatively safe, but somewhat difficult in the supine position, gaining entry to the anterior compartment using either the anterolateral or anteromedial portal as a starting portal brought the risk of injuring the radial nerve or median nerve, respectively, with it. Repeatedly, the need for a standardised and reproducible method of portal placement was expressed.

In 1989, Poehling et al introduced the prone position and, more importantly, the proximal medial portal (figure 1). The work of Poehling et al transitioned elbow arthroscopy from being pioneer work to a safe and reliable surgical procedure, and is therefore chosen as the topic of this classic. From the perspective of the classic paper

Summary of the classic

► Recognising the difficulty of accessing the posterior compartment in the supine position, Poehling et al6 adapted the prone position, which was then successfully used in nine patients. The patient is positioned prone on chest rolls, the arm in an arm holder slightly higher than the shoulder, arm freely hanging off the table, with the shoulder in 90° abduction and elbow in 90° flexion. The main advantage of this new prone position was improved access to the posterior compartment, along with improved joint stability and joint mobility during surgery.

► Second, based on previously performed cadaveric studies assessing elbow anatomy and portal placement and their own anatomy analysis, Poehling et al6 introduced the proximal medial portal as a starting portal. The proximal medial portal is located 2 cm proximal to the medial epicondyle and just anterior of the medial intermuscular septum (figure 1). The blunt trocar and sheath are introduced anterior to the medial intermuscular septum to avoid injury to the ulnar nerve, and while sliding downwards directed towards the radial head, contact is kept with the anterior humerus to avoid injury to the median nerve and brachial artery. The proximal medial portal provided the first established safe and reproducible introduction into the elbow joint, and provided an excellent visualisation of the anterior compartment. The introduction of the prone position and proximal medial portal allowed a more complete visualisation of the elbow joint and simplified the arthroscopic technique.
by Poehling et al., a historic overview of elbow arthroscopy is provided and the impact of their work discussed.

CONSIDERATION

Historic perspective

In 1931, Burman concluded that the elbow joint was not compatible for arthroscopy ‘since the joint space is so narrow’, and an anterior approach was ‘out of the question’. It was only a year later, in 1932, that Burman reconsidered his statement as he was able to successfully visualise the anterior compartment

Portals placement and patient positioning

In 1985, Andrews and Carson were the first to describe a detailed set-up including by then commonly used portals: the anterolateral portal placed approximately 3 cm distal and 1 cm anterior to the lateral epicondyle (figure 2), the anteromedial portal placed approximately 2 cm distal and 2 cm anterior to the medial epicondyle (figure 1) and the posterolateral portal placed approximately 3 cm proximal to the olecranon tip with the elbow in extension just lateral to the triceps tendon (figures 3, 4). They placed their patients in the supine-suspended position, with the shoulder in 90° abduction and elbow in 90° flexion while suspended overhead using a wrist gauntlet and suspension device. The supine-suspended position provided excellent access to both the medial and lateral aspects of the elbow, and allowed free rotation of the forearm. Although accessing the posterior compartment was somewhat difficult, it was relatively safe. Accessing the anterior compartment using an anterolateral portal or anteromedial portal put the radial or median nerve, respectively, at risk for injury. At the time, it was felt that the anterolateral approach was safest and was therefore commonly used for placing a starting portal. Morrey stated in 1986: “I rarely have used any of the medial approaches, because I believe that the risk of complication exceeds the potential benefits in most instances.”

Lynch et al., in 1986, were the first to investigate the actual nerve-to-portal distances, along with the protective effect of elbow flexion and joint distension, in a cadaveric study. They used the portals as described by Andrews and Carson, and confirmed that the posterolateral portal was indeed relatively safe with the closest nerve, the medial brachial cutaneous nerve, at a mean distance of 20 mm (range, 8–27 mm). In contrast, the posterior antebrachial cutaneous nerve and radial nerve were found as close as 1 and 3 mm, respectively, to the anterolateral portal, and the medial antebrachial cutaneous nerve, median nerve and brachial artery were found as close as 1, 3 and 8 mm, respectively, to the anteromedial portal. After joint distension with the elbow in flexion, the radial nerve, median nerve and brachial artery moved anteriorly an additional 7, 10 and 8 mm, respectively. The mean nerve-to-portal distance after distension was found similar for the radial nerve and median

The Classic

Figure 1 A schematic representation of the medial elbow in 90° flexion and medial portal sites. (A) Anteromedial portal as described by Andrews and Carson, 2 cm distal and 2 cm anterior of the medial epicondyle. (B) Proximal medial portal as introduced by Poehling et al., 2 cm proximal of the medial epicondyle and just anterior of the medial intermuscular septum.

Figure 2 A schematic representation of the lateral elbow in 90° flexion and lateral portal sites. (A) Anterolateral portal as described by Andrews and Carson, 3 cm distal and 1 cm anterior of the lateral epicondyle. (B) Midlateral portal as described by O'Driscoll and Morrey, 1 cm distal and 1 cm anterior of the lateral epicondyle. (C) Proximal lateral portal as introduced by Stothers et al., 2 cm proximal of the lateral epicondyle and directly on the anterior humerus. (D) Direct lateral portal or ‘soft-spot’ portal as first described by Morrey in 1986, placed in the triangle formed by the lateral epicondyle, radial head and olecranon tip.
The Classic

nerve with 11 and 14 mm, respectively. Joint distension was performed by injecting 35–40 cc of lactated Ringer’s solution via the ‘soft-spot’, located at the triangle formed by the lateral epicondyle, radial head and olecranon tip, into the elbow joint. Elbow flexion of 90° allowed the neurovascular structures to relax and move anteriorly with joint distension. Lynch et al. also recognised that the cutaneous nerves around the elbow could be easily damaged with penetration of subcutaneous tissue, which led to recommend skin incision only and further blunt dissection onto the capsule when establishing portals to avoid injury to the cutaneous nerves.

Despite preventive measures as elbow flexion and joint distension, the occurrence of nerve injuries was still seen as an issue as several nerve injuries were mentioned in the earliest clinical applications of elbow arthroscopy up to 1989. Andrews and Carson, and Morrey reported a transient median nerve and radial nerve palsy likely related to extravasation of anaesthetics. Guhl reported damage to a sensory branch of the radial nerve. Small reported a radial nerve injury after elbow arthroscopy. Lynch et al. also recognised that the cutaneous nerves around the elbow could be easily damaged with penetration of subcutaneous tissue, which led to recommend skin incision only and further blunt dissection onto the capsule when establishing portals to avoid injury to the cutaneous nerves.

In 1989, Poehling et al. responded to this need with proximalisation of the anteromedial portal, the proximal medial portal (figure 1). Their key to success for the proximal medial portal was the use of anatomic barriers, the medial intermuscular septum and brachialis muscle, as direction indicators and additional layers of nerve protection. By placing the portal proximal instead of distal to the median nerve, the distance to the median nerve increased compared with the anteromedial portal. Moreover, by placing the portal anteriorly of the median nerve, the distance from the median nerve to the anteromedial portal was greater than the distance from the anteromedial portal to the median nerve.

**Scientific and societal impact**

**Portal placement**

Overall, it seemed that portal entry sites were mainly chosen based on the amount of joint visualisation they would provide, rather than their safety margin towards important neurovascular structures. There was need for easily reproducible portals that would reduce the imminent risk for nerve injury.

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towards the radial head, the medial intermuscular septum forms a barrier posteromedially protecting the ulnar nerve from injury, and the brachialis muscle forms a barrier anteriorly protecting the median nerve and brachial artery. In addition, the proximal location of the portal allows distal and almost parallel orientation of the arthroscope to the nerves, reducing the chance of nerve injury. In contrast, the anteromedial portal is inserted almost tangentially onto the nerves. Do not place the proximal anteromedial portal >2 cm proximal to the medial epicondyly as the medial intermuscular septum is absent there, putting the ulnar nerve at risk for injury.

Not long after the proximalisation of the anteromedial portal by Poehling et al, the proximalisation of the anterolateral portal followed. In 1992, O’Driscoll and Morrey described the use of an anterolateral portal located directly at the sulcus of the radiocapitellar joint, 1 cm anterior and only 1 cm distal to the lateral epicondyly, also called the midlateral portal (figure 2). One year later, Stothers et al introduced the proximal lateral portal, 1–2 cm proximal to the lateral epicondyly directly on the anterior surface of the humerus (figure 2). Herewith, the original technique described by Andrews and Carson was abandoned, as it often led to portal placement distal of the radiocapitellar joint putting the posterior interosseous nerve at risk for injury.

Both the proximal medial portal and proximal lateral portal were proven safer in contrast to their more distal counterparts regarding the risk of nerve injury. In addition, the proximal lateral portal was found to provide better visualisation of the radial head and lateral gutter compared with the anterolateral portal, the proximal medial portal provided improved visualisation of the proximal radioulnar joint compared with the anteromedial portal, and combined they allowed complete assessment of the anterior compartment.

With the introduction of the proximal medial portal, a first safe and reproducible portal to acquire access to the anterior compartment was established. The proximal medial portal and the proximal lateral portal are still the most commonly used starting portals for elbow arthroscopy of the anterior compartment today.

Patient positioning
By adaptation of the prone position with the elbow in approximately 90° flexion, Poehling et al (1) established easier access to the posterior compartment, granting complete visualisation of the elbow joint, and more thorough treatment options, (2) increased joint stability by direct support during arthroscopy compared with suspension in midair and (3) increased joint mobility as the elbow could be moved freely through flexion and extension in addition to forearm rotation. Nevertheless, the prone position had two downsides: difficult patient positioning and difficult access for the anaesthesiologist to the airways. A modification of the prone position, the lateral decubitus position, was introduced by O’Driscoll and Morrey in 1992, wherein the patient is placed with the affected side uppermost, the arm in a padded holder with the elbow in 90° flexion and the forearm hanging free. This position allowed the same elbow position as in the prone position while granting better airway access to the anaesthesiologist and easier patient positioning. Another advantage is that the elbow is now positioned highest in the operating field, reducing the chance of the arthroscope and instruments coming into contact with the patient. The lateral decubitus position is still commonly used.

Societal impact
With the introduction of the proximal medial portal, Poehling et al established the first portal that allowed safe and reproducible access to the anterior compartment, that is still commonly used as a starting portal for access to the anterior compartment. The introduction of the prone position allowed for easier access to the posterior compartment, increased haptic feedback due to increased joint stability and free arm movement that could aid in portal placement and joint visualisation. Together, the proximal medial portal and prone position, allowed for a safer and more complete visualisation of the elbow joint which increased the interest of the orthopaedic community in elbow arthroscopy, and eventually allowed for expansion of indications, and more complete treatment of elbow pathology.

Current evidence as related to the original article
Thirty years after the work of Poehling et al, elbow arthroscopy has become a safe and effective surgical procedure due to increased understanding of the elbow anatomy and advances in technique and instruments. This has allowed variety of elbow pathology that is treated with elbow arthroscopy to broaden exponentially over the past decade. In 1989, when Poehling et al published their paper, elbow arthroscopy mainly had a diagnostic purpose with the only firm indication for surgical arthroscopy being loose body extraction. At present time, indications for elbow arthroscopy have broadened with treatment for rheumatoid arthritis, degenerative arthritis, radial head resection, arthrofibrosis, posteromedial impingement, osteochondritis dissecans (OCD), selected fractures of the radial head, coronoid and capitellum, plica excision, lateral epicondylitis and posterolateral rotatory instability.

The portals of today
The portals that are needed during elbow arthroscopy are dependent on the expected elbow pathology, access to the anterior compartment is established with use of a proximal medial portal or proximal lateral portal. Combined, the proximal medial and proximal lateral portals provide excellent visualisation of nearly the entire anterior elbow joint, except for the superoanterior capsule and inferior articular surfaces. Starting laterally, while viewing from the proximal medial portal, the lateral gutter, lateral capsule, origin of the extensor carpi radialis brevis (ECRB), radial head, annular ligament, anterior capitellum, anterior capsule and while pulling the arthroscope backwards the anterior proximal radioulnar joint, coronoid tip, coronoid fossa and anterior trochlea can be assessed. By switching the arthroscope to the proximal lateral portal using a switching stick, the medial capsule, anterior bundle of the ulnar collateral ligament and lateral gutter can be assessed as well. While viewing from laterally the ulnar collateral ligament can be assessed for insufficiency by performing the arthroscopic valgus stress test. Commonly used additional portals for introduction of instruments or visualisation of the superoanterior capsule are the anterolateral and anteromedial portals, preferably created using an inside-out technique to prevent nerve injury. Accessory proximal medial and proximal lateral portals can be created for insertion of retractors that can be used to hold the capsule away from the instruments. Interchangeable use of the aforementioned portals as viewing or working portals allows treatment of the majority of elbow pathology in the anterior compartment, such as ECRB release for lateral epicondylitis, radiohumeral plica excision, loose body and osteophyte removal in osteoarthritis, synovectomy in post-traumatic or inflammatory arthritis.
anterior capsular release for stiff elbow, radial lateral collateral ligament repair and anterior capsular plication for posterolateral rotatory instability and debridement or fixation of OCD lesions on the anteroinferior aspects of the capitellum, trochlea and radial head.

Use of a direct lateral portal, first described by Morrey in 1986, or a posterolateral portal may be desirable for optimal visualisation and treatment of elbow pathology located in the posterolateral compartment, for example, debridement of posterolateral capitellar OCD lesions, removal of loose bodies in the lateral gutter, assessment for and treatment of posterolateral rotatory insufficiency, radiohumeral plica excision and radial head resection. The direct lateral or ‘soft-spot’ portal is located within the triangle formed by the radial head, olecranon tip and lateral epicondyle, and provides good visualisation of the posterior and inferior capitellum, inferior proximal radioulnar joint and inferior trochlea. When using the direct lateral portal the posterior antebrachial cutaneous nerve, at an average distance of 7 mm, is most at risk for injury. A dual direct lateral approach has been suggested as an approach for capitellar OCD treatment. The posterolateral portal that provides access to the posterolateral compartment is created 1 cm proximal to the direct lateral portal in line with the standard posterolateral portal described by Andrews and Carson. In addition to the direct lateral and posterolateral portal, van den Ende et al developed a specialised portal, the distal ulnar portal, to facilitate visualisation and treatment of capitellar osteochondral lesions. It is inserted 3–4 cm distal to the posterior aspect of the radiocapitellar joint just lateral of the ulnar crest providing excellent visualisation of the posterolateral capitellum, and due to the portal trajectory it is optimal for drilling, shaving, fixation or microfracturing of capitellar OCD lesions (figure 3).

Over time the standard posterolateral portal and posterocentral portal remained the ‘golden standard’ portals for assessment of the posterior compartment with the closest nerve distances in between 15 and 25 mm. The posterocentral portal is placed 3 cm proximal to the olecranon tip with the elbow in 45° flexion while aiming directly for the olecranon fossa (figures 3, 4), offering visualisation of the olecranon fossa, olecranon tip, posterior trochlea, medial and lateral gutter, medial and lateral capsule. An accessory posterocentral portal, 1–2 cm proximal to the posterocentral portal, and accessory posterolateral portals, between 1 and 3 cm proximal to the direct lateral portal in line with the standard posterolateral portal, can be created to introduce instruments or retractors. The standard posterolateral portal provides visualisation of the lateral gutter, posterior capitellum, posterior trochlea, olecranon tip, olecranon fossa and medial and posterosuperior capsule (figures 3, 4). Using these portals one can treat posteromedial impingement and osteoarthrosis by removing loose bodies and osteophytes, flexion contractures by posterior capsular release, synovitis in inflammatory arthritis or post-traumatic arthritis by synovectomy and OCD lesions of the posterior trochlea and capitellum by debridement with or without microfracturing. Posteromedial portals have always been avoided due to closeness of the ulnar nerve, and if absolutely necessitated should only be created after identification and isolation of the ulnar nerve. Working in the posteromedial compartment remains risky as the ulnar nerve lies almost directly on the medial capsule with an average distance between the capsule and nerve of just 3 mm (range 2–5 mm).

Complications

Despite the advancements in elbow arthroscopy technique, nerve injury remains a risk due to the neurovascular anatomy around the elbow joint. The rate of nerve injury has been reported between 0% and 10% in studies with 50 or more performed elbow arthroscopies and may still be under-reported. The majority of nerve

Advancements in portal safety

Since the introduction of the proximal medial portal by Poehling et al and the proximal lateral portal by Stothers et al, it was felt optimal portal placement for arthroscopy of the anterior compartment had been established and not much profit could be gained with new portals. Instead, attention shifted to strategies to optimise portal placement techniques. Examples of such strategies are shown in box 1.

Box 1 Strategies developed to increase portal placement safety

- **‘Outside-in’ or ‘inside-out’ technique**
  Use an ‘outside-in’ technique, placing a needle from the outside-in to ensure accurate portal placement, or ‘inside-out’ technique to safely establish secondary portals after using a proximal medial or proximal lateral starting portal.

- **Use of pronation**
  Use pronation, in addition to elbow flexion and joint distension, when placing anterolateral portals to increase the distance of the portal to the radial nerve.

- **Retractor use**
  Use retractors to help lift the capsule to increase working space and hold nerves away from the working area.

- **Avoid use of automated instruments near the capsule**
  Avoid use of suction or motorised instruments near the capsule, particularly around the radial head and in the posteromedial compartment.

- **Hooded burrs and shavers**
  If use of a motorised instrument is necessitated, use hooded burrs or shavers, and point the burr/shaver away from the capsule.

- **Trocar removal between assessment of anterior and posterior compartment**
  Remove trocars from the anterior compartment when assessing the posterior compartment to prevent compression of the nerves with elbow extension.

- **Palpate the course of the ulnar nerve**
  Always palpate the course of the ulnar nerve prior to anteromedial or proximal medial portal placement. This particularly counts in patients with a subluxing or previously transposed ulnar nerve where blind placement may lead to ulnar nerve injury. Based on the certainty with which the ulnar nerve course can be palpated the portal can be placed safely using the algorithms proposed by Sahajpal et al and Park et al; either in a standard fashion if the ulnar nerve course is unequivocal or after skin incision and nerve identification if the course is equivocal or impossible to determine.
Question 1: Nerve injury remains of concern in elbow arthroscopy inherent to the elbow anatomy. Is there still room for improvement in nerve injury prevention?

Adam Watts: Yes, regarding the ulnar nerve, I recommend always performing an open in situ decompression if the ulnar nerve is unstable, patients have any ulnar nerve symptoms or there has been previous surgery around the nerve. Furthermore, always stay close to bone, particularly important for arthroscopic tennis elbow release, to prevent nerve injury. Little attention is paid to (the branch of the radial) nerve innervating the anconeus muscle, it lies on the joint capsule in the lateral recess midway between the olecranon and lateral epicondyle and everyone ignores it. Making a skin incision only with a blade and thereafter blunt dissection reduces the risk of nerve injury, but the nerve is still at risk from capsulectomy as it lies on the joint capsule at this level. It is not possible to completely avoid this area when gaining access to the lateral compartment. Detailed cadaveric description of all the nerves at risk from the arthroscopic view would be useful. Lastly as you say—know your limits!

Question 2: Has the potential of elbow arthroscopy been reached to date? What does the future of elbow arthroscopy hold?

Adam Watts: No, arthroscopic techniques are still expanding. Current growing areas of potential are arthroscopic management of elbow trauma (eg, acute stabilisation surgery), and elbow arthroplasty (eg, mechanical and microbiological assessment of the painful total elbow arthroplasty as described by Phadnis and Bain, and humeral canal cement removal during revision surgery). There is also an expansion into endoscopic techniques around the area with novel techniques for biceps reconstruction and potential for techniques to perform debridement for golfer’s elbow.

Question 3: Is there a topic that is underexposed in current elbow arthroscopy research, which deserves more attention?

Adam Watts: There are several topics I believe need further exploration, including preinfiltration with ropivacaine to reduce analgesia requirement, and preoperative resection planning for osteoarthritis using CT and three-dimensional (3D) modelling with dynamic finite element analysis models. The 3D optics and computer-assisted surgery are under investigation with the aim of improving the results of osteocapsular arthroplasty—one of the most commonly performed elbow arthroscopy procedures.

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Expert opinion by Professor Adam Watts

Professor Adam Watts is a Fellowship-trained Hand and Upper Limb Surgeon at Wrightington Hospital. He specialises, among other areas, in arthroscopic and endoscopic surgery of the elbow.

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injuries are transient, but permanent nerve injuries do occur. In a survey conducted by Desai et al among the members of the American Society for Surgery of the Hand, 222 nerve injuries were reported after elbow arthroscopy, of which 38% involved the ulnar nerve, 22% the radial nerve and 19% the posterior interosseous nerve. About half of the patients with nerve injury required surgical reintervention, of this half 77% had incomplete motor recovery, thus permanent nerve injury. Patients with rheumatoid arthritis or a contracture are at higher risk for sustaining nerve injury due to a thin capsule and atrophic brachialis muscle, and less working space, respectively.

The overall complication rate for elbow arthroscopy has been reported between 0% and 14% in studies with 50 or more patients. Besides nerve injury, reported complications include prolonged drainage from portal sites/superficial infection (0%–11%), deep infection (0%–2.2%), elbow stiffness (0%–3.5%), heterotopic ossification (0%–1.4%), and hematoma (0%–2%). Identified risk factors for infection after elbow arthroscopy are intra-articular corticosteroid injection during elbow arthroscopy, obesity, age (≥65 years), tobacco usage, alcohol usage, diabetes mellitus, inflammatory arthritis and hypercoagulable disorder. Obesity (BMI >30) has also been found to substantially increase the risk for nerve injury or elbow stiffness within 90 days after surgery. In general, patients with a history of elbow trauma or previous surgery are at higher risk for complications of elbow arthroscopy, due to distorted anatomy and capsular contraction.

Surgeon’s experience

Although the advances in elbow arthroscopy technique have made it a procedure that can be applied to a continuous increasing range of indications, and the increased understanding of the elbow anatomy and portal placement made it possible to be performed safely, the influence of surgeon’s experience should not be underestimated. The number of surgeons performing elbow arthroscopy has increased rapidly along with the broadening of the indications, which may interfere with the necessary experience needed to perform elbow arthroscopy safely. In the hands of the inexperienced surgeon, elbow arthroscopy can still have disastrous consequences. To stress the latter, Claessen et al noted a 30% complication rate with portal placement by novice surgeons, compared with the above-mentioned overall complications rate of 0%–14% among experienced surgeons. A surgeon has to be knowledgeable of his skills and limitations, and should only perform elbow arthroscopy in those cases he is competent. Most importantly, surgeons should move slowly up the arthroscopic skill ladder, only advancing to complicated indications once sufficient experience has been attained with simpler procedures. Novice surgeons in elbow arthroscopy should confine their indications to diagnostic arthroscopy, and removal of loose bodies and small osteophytes. With growing experience indications requiring more advanced technical skills can gradually be added, reserving procedures as extensive capsular release, arthroplasty and treatment for posterolateral rotatory instability for experts only.

Surgeons who strive to become proficient in elbow arthroscopy should have as much exposure during their training as possible, be it simulation training, cadaveric training or in the operating theatre. Additional fellowship training is strongly recommended to acquire sufficient elbow arthroscopy skills.
The Classic

Expert opinion by Dr Luke S Oh

Dr Luke S Oh is a Fellowship-trained Shoulder and Elbow Surgeon at the Sports Medicine Service of Massachusetts General Hospital, USA. He specialises, among other areas, in arthroscopic surgery of the elbow. We have asked him for his perspective on the safety and future of elbow arthroscopy:

When considering new frontiers or innovations in any field, whether it be within medicine or not, I believe it is prudent to study the history and evolution of a technique, technology or way of doing things so that we may be better prepared to understand which boundaries to push and how. We truly stand on the shoulders (and elbows) of giants who advanced the field of elbow arthroscopy, starting from Dr Michael Burman who in the 1930s studied elbow anatomy and safe portal placement to Dr Gary Poehling who taught countless surgeons about arthroscopic techniques in the elbow as a leader in the International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine. I myself have special mentors to thank for teaching me this craft and for advancing the field of elbow surgery and arthroscopy: Drs Bernard Morrey, Shawn O’Driscoll, Scott Steinmann, Joaquin Sanchez-Sotelo and James Andrews. As we push the envelope and expand the indications for elbow arthroscopy, I believe that there are external as well as internal challenges:

An external challenge may be to optimise the delivery of educational content and surgical training. As digital media and video streaming become more and more mainstream in our society, a popular medium for surgical instruction nowadays is through digital or online technique videos. In addition to VuMedi and YouTube, some of the national and international orthopaedic societies as well as a few orthopaedic journals now offer educational content delivered via online videos streams. The quality of some of these instructional videos has reached a very high level of sophistication. Although they offer convenience, these beautifully manufactured videos with varying degrees of video editing may leave out some of the most useful and instructive parts of the surgery: the portions of the procedure in which the surgeon struggles. Learning how to avoid common pitfalls that lead to a struggling situation in the first place is critically important, but learning how to get out of trouble as soon as a surgical case starts to get difficult is also an important skillset in order to steer away from a potential complication. Watching videos of ‘perfectly’ performed surgery is helpful to understand the standard that we aim for in every surgery, but the supervision of a less experienced surgeon during his/her learning curve by an experienced mentor cannot be replaced by surgical technique videos, no matter how well it has been produced. This highlights the importance of fellowship training as well as surgical cadaver courses that offer case volume, supervision and mentorship. We are fortunate to have so many experts in ISAKOS who are active in teaching and education through lectures and surgical technique courses.

The internal challenge is that we need to be careful not become a hammer that sees the world as a nail. Patient safety and minimising neurovascular injury risk must continue to be our priority as we make technique innovations with the arthroscope in the elbow. We have ISAKOS members, for example, working on perfecting endoscopic techniques for extra-articular pathology such as endoscopic distal biceps repair as well as arthroscopic nerve decompression. Some of the amazing technical feats accomplished by our most experienced colleagues, such as Drs Greg Bain and Roger van Riet, also begs the question: Who should be performing these types of technically challenging procedures with a steep learning curve? For situations in which a patient has a complex elbow condition requiring technical expertise and experience beyond one’s own skill set, referring that patient to a more experienced colleague would be the correct decision. Honest self-assessment, maintaining humility and understanding our own limitations with regard to experience and technique will be an important component of maintaining patient safety during complex elbow arthroscopy cases.

Personal lessons of Dr Adam Watts (UK)

► Do not infiltrate the elbow joint through the soft sport, this may cause cartilage damage. Rather, infiltrate through the posterior midline into olecranon fossa, I learnt this lesson from Professor Dr Denise Eygendaal.

► For osteocapsular arthroplasty start in the posterior compartment, this compartment often needs a lot of work to clear osteophytes, then address the lateral compartment and finish in front where a capsular release can be performed. Starting in the front makes little sense as the elbow will swell significantly due to fluid extravasation, making you struggle to do the rest. You could start in the front and come back at the end to do the capsular release, but we try not to have to go back to a compartment we have been to already as this is inefficient.

CONCLUSION

The classic by Poehling et al\(^6\) introduced the proximal medial portal and the prone position, greatly contributing to the feasibility of elbow arthroscopy. The proximal medial portal was the first established safe and reproducible portal for access to the anterior compartment, and is still used today. The prone position provided a stable surgical set-up and improved access to the posterior compartment. With these two techniques, Poehling et al\(^6\) showed that elbow arthroscopy could be performed safely and reliably, which increased the interest of the orthopaedic community and eventually the adaptation of elbow arthroscopy into the common orthopaedic practice.

Despite the technical advances and increased safety of elbow arthroscopy, thorough understanding of elbow anatomy and pathology, and arthroscopic technique remain prerequisites for a safe elbow arthroscopy. Furthermore, it is paramount to match a surgeon’s experience with the complexity of the case to ensure safe elbow arthroscopy, particularly as indications will likely keep broadening and increasing in complexity in the near future.
The Classic

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