



Avoidance of Direct Posterior Portal During Elbow Arthroscopic Surgery in Posterior Compartment

Cholawish Chanlalit, M.D., Chidchanok Sakdapanichkul, M.D., and Nattakorn Mahasupachai, M.D.

Abstract: Arthroscopic surgery for the posterior compartment in elbow has been used in the treatment of many pathologies. The direct posterior portal has been commonly used for this compartment. However, this portal involves penetrating the triceps brachii tendon responsible for extensor mechanism. This can possibly lead to poor performance during recovery and portal wound sensation with scar formation. An accessory posterolateral portal can be used as a substitute with adequate viewing and working space in all areas of the posterior compartment. This report describes in detail on how to manage pathologies in the posterior compartment without using direct posterior portal and instead using accessory posterolateral, posterolateral, and direct lateral portals.

In the posterior compartment of the elbow, 3 main portals commonly used are the direct lateral, posterolateral, and direct posterior portals.¹⁻⁸ Each portal, with a different location around the elbow joint, has its own advantage. The direct lateral portal is used for working at the area of the posterior radiocapitellar joint. The posterolateral portal can be used to gain access to the posterolateral gutter. The direct posterior portal is usually used for starting portal and for viewing medial and lateral gutters. However, this portal involves penetrating central triceps brachii tendon.

Injury to a tendon postoperatively can cause a problem. For example, creating a portal through the patellar

ligament in the knee eventually penetrates through the extensor mechanism. This can lead to poor performance during recovery and portal wound sensation with scar formation.⁹ Similarly, in the elbow, creating a direct posterior portal for posterior compartment can create the same issue.

The triceps brachii tendon is composed of 2 parts for distal insertion at olecranon. There are the superficial tendinous part, corresponding to the lateral and long heads of triceps, and the deep muscular part, corresponding to the medial head of triceps.¹⁰⁻¹³ Creating a direct posterior portal can injure these 2 layers of the triceps brachii, which can negatively affect the postoperative rehabilitation during recovery and the portal wound sensation with scar formation.

Avoiding using the direct posterior portal can not only prevent complications but also creates the expectation of a faster recovery. An accessory posterolateral portal can be used for a substitution (Fig 1). Besides being able to view the posterolateral gutter, this portal also can be used to gain access to the posteromedial gutter with elbow extension. This alternative portal can be an interesting option for surgeons who are concerned about triceps disturbance or would perform a triceps procedure for the next procedure, such as endoscopic olecranon spur and reinsertion of the triceps or distal triceps repair.^{14,15}

This Technical Note demonstrates a working in posterior compartment without using direct posterior portal. An example is a patient with diagnosis of pathologic plica who received arthroscopic plica resection in the anterior and posterior compartments.

From the Center of Excellence in Upper Extremity Reconstruction and Sports Medicine, HRH Princess Maha Chakri Sirindhorn Medical Center, Faculty of Medicine, Srinakharinwirot University, Nakhon Nayok (C.C., N.M.); and Department of Orthopaedics, Nopparat Rajathanee Hospital, Khwaeng Khan Na Yao, Khet Khan Na Yao, Bangkok (C.S.), Thailand.

The authors report no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as [supplementary material](#).

Received April 28, 2023; accepted July 29, 2023.

Address correspondence to Cholawish Chanlalit, M.D., Department of Orthopedics, 6th floor of Faculty of Medicine Building, Srinakharinwirot University, 62 Moo 7 Ongkharak, Ongkharak, Nakhon Nayok 26120. E-mail: chanlalit@hotmail.com

© 2023 Published by Elsevier Inc. on behalf of the Arthroscopy Association of North America. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2212-6287/23613

<https://doi.org/10.1016/j.eats.2023.07.047>

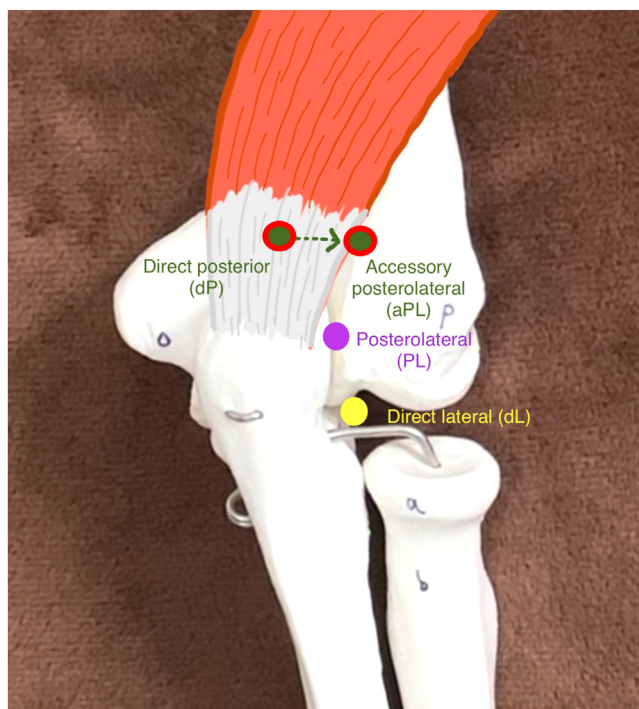


Fig 1. A diagram of portals for posterior compartment. Arrow shows changing the use of direct posterior (dP) portal to the accessory posterolateral (aPL) portal to avoid triceps disturbance. (dL, direct lateral; PL, posterolateral.)

Surgical Technique (With Video Illustration)

Anesthesia and Positioning

We prefer to use general anesthesia to allow immediate postoperative nerve evaluation without the interference of a regional block effect. The patient is placed in lateral decubitus. The nonoperative extremity is set with shoulder and elbow flexed with axillary roll

applied. A pneumatic tourniquet is applied to the operative arm proximally. An arm support is used for the operative arm to rest on with the elbow flexion of 90° in resting position. The position of the arm support is set properly to make sure the elbow can be fully extended and deeply flexed (Fig 2A).

Portal Placement and Debridement of Plica in Anterior and Posterior Compartments

After preparation and draping, skin marking is performed to identify relevant anatomy, including lateral and medial epicondyles, olecranon, and ulnar nerve (Fig 2B). Starting at anterior compartment, a proximal anteromedial portal is initially made for the viewing portal. The portal is 2 cm proximal to medial epicondyle and 1.5 to 2.0 cm anterior to intermuscular septum. After the skin incision, a blunt trocar is passed through the flexor-pronator and brachialis muscle before entering the joint. Then, an anterolateral portal is created for the working portal. The landmark will be at radiocapitellar joint level in longitudinal axis and dorsovolar axis. It will be 1.0 to 1.5 cm distal to lateral epicondyle. The portal is created using outside-in technique with direct visualization via the proximal anteromedial portal. A no. 18 needle is used to locate the proper location of anterolateral portal. Then, a no. 15 blade is used to create portal and straight tip clamp is used to dilate the portal. Working instrument is inserted through anterolateral portal. The anterior plica is resected and, in case of concomitant presence of lateral epicondylitis, the extensor carpi radialis brevis is debrided. These procedures usually involve a 3.5-mm motorized shaver (Sterling Cuda blade; CONMED, Largo, FL) and a bipolar arthroscopic radiofrequency cautery (Edge with 90 probe; CONMED) (Fig 3A-D).

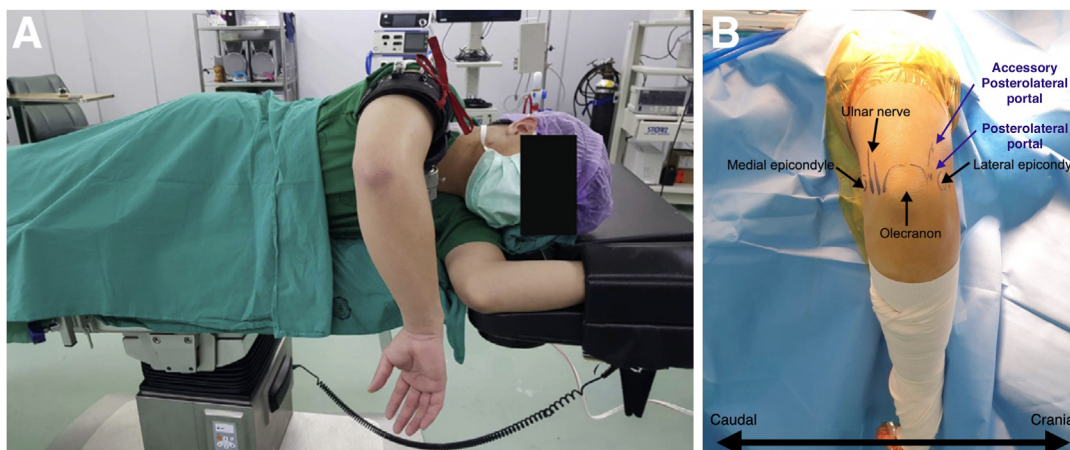


Fig 2. Setting up. (A) The patient is set in lateral decubitus with right elbow on an arm support. (B) Important landmarks are drawn—lateral and medial epicondyles, ulnar nerve, and olecranon. The posterolateral portal is located lateral to lateral border of triceps tendon, which is between the olecranon and lateral epicondyle. Accessory posterolateral portal is 2 to 3 cm proximal to the posterolateral portal. The insertion is lateral to the triceps muscle.

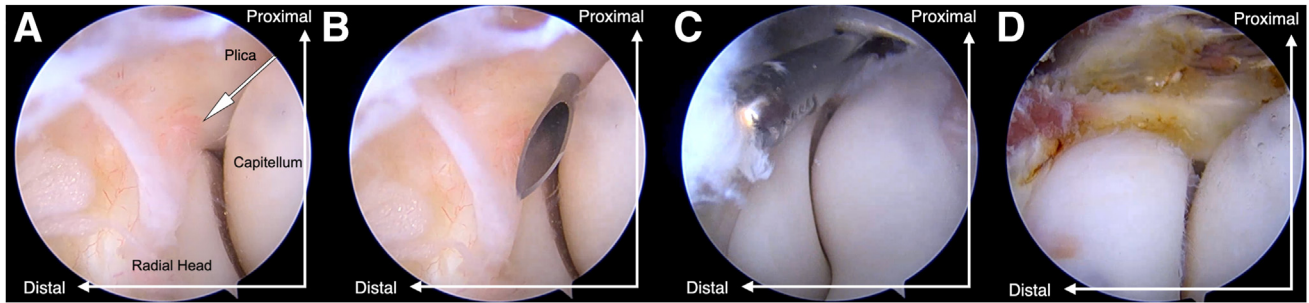


Fig 3. Anterior compartment. Viewing from proximal anteromedial portal, (A) anterior plica wrapping around the radial head is seen. (B) An anterolateral portal is created with an outside-in technique with direct visualization of the arthroscopic camera by starting with using a no. 18 needle. After skin incision with a no. 15 blade and subcutaneous tissue dissection with a clamp, (C) a 3.5-mm motorized shaver and a bipolar arthroscopic radio frequency cautery are used for resecting the plica. (D) Plica in anterior compartment is resected.

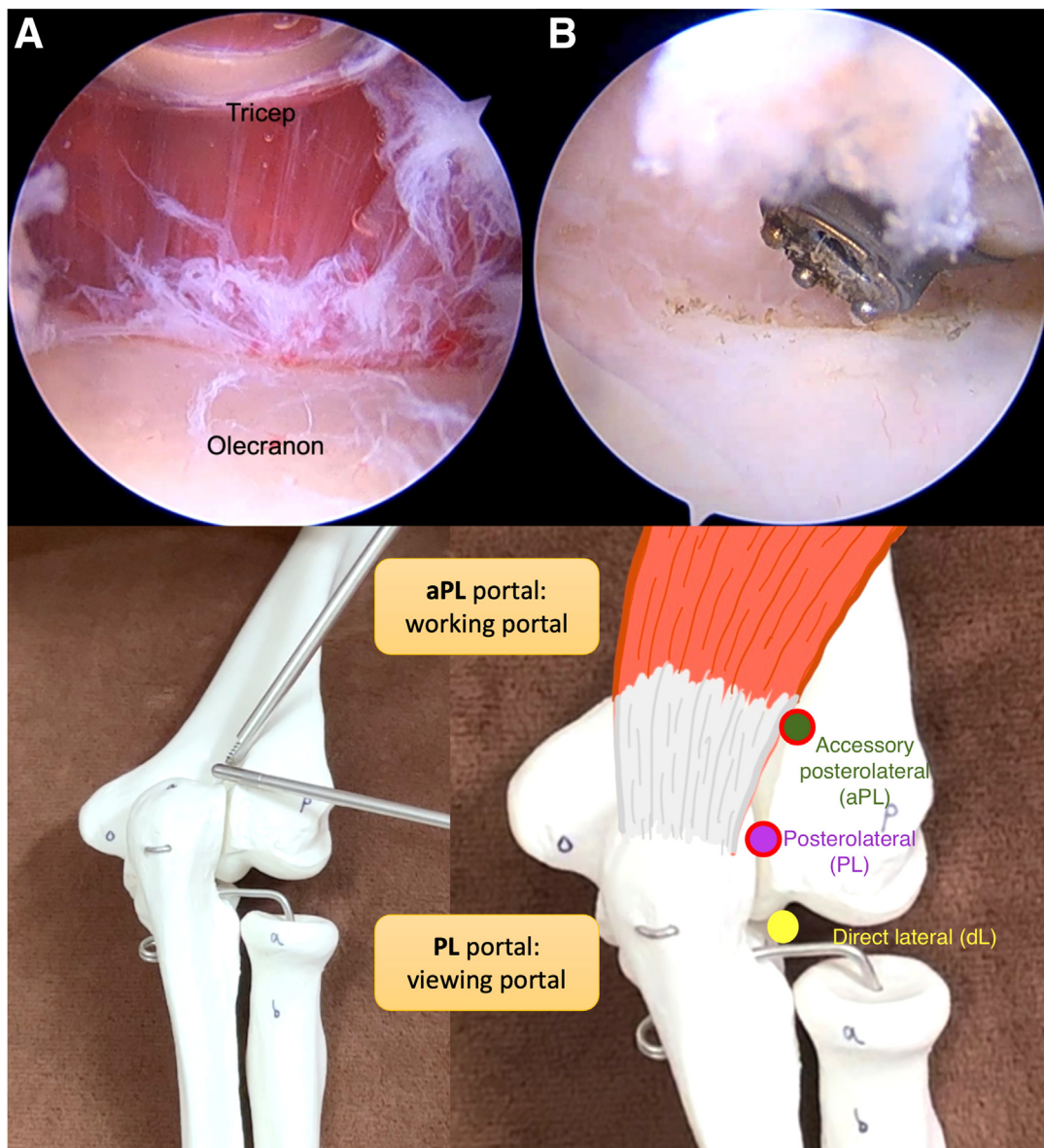


Fig 4. Posterior compartment. (A) A posterolateral portal is created as an initial viewing portal. (B) An accessory posterolateral portal is created and used for clearing unnecessary soft tissue to extend working space. The shaver is at olecranon fossa (aPL, accessory posterolateral; PL, posterolateral.).

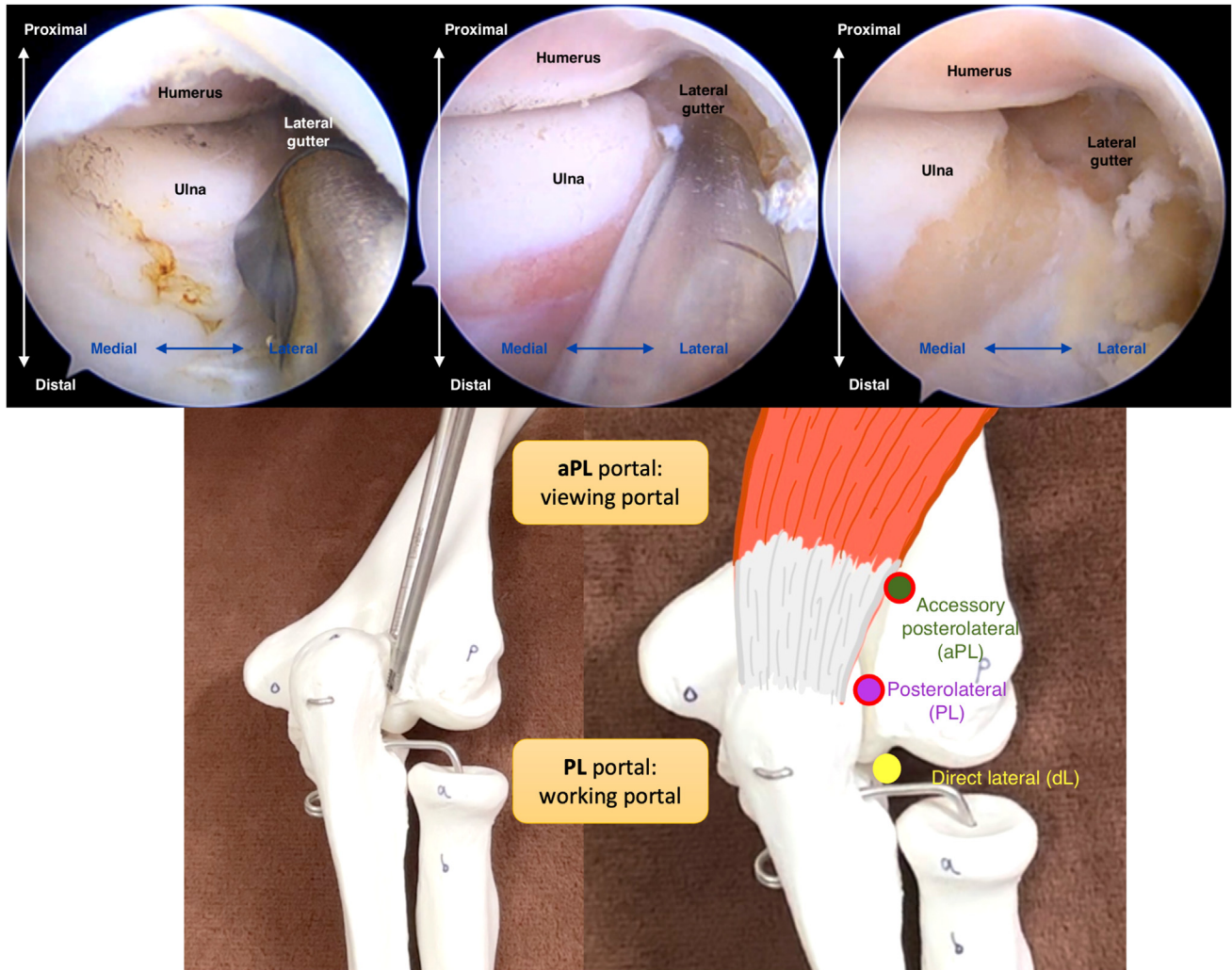


Fig 5. Posterior compartment. With elbow extension, viewing from accessory posterolateral portal and working from posterolateral portal, plica in the posterolateral gutter was resected. Using these 2 portals in lateral gutter makes the camera and working instrument become almost parallel to each other and may lead to instruments jamming. Placing the working instrument in front of the camera can solve this issue.

Proceeding to posterior compartment for debridement of posterolateral plica, a posterolateral portal is created for initial viewing portal. The portal is located lateral to lateral border of triceps tendon, which is between the olecranon and lateral epicondyle. The skin is incised and straight clamp was used to widen the opening. Wissinger rod is inserted and directed to the lateral gutter before the camera was applied. Using this portal, structures that can be seen are bare area of cartilage in olecranon, sigmoid notch, radial head facet, and lateral capsule (Fig 4A).

Next, an accessory posterolateral portal is created for working portal, which is 2 to 3 cm proximal to the posterolateral portal. The insertion is lateral to triceps muscle. The bipolar arthroscopic radiofrequency cautery (Edge with 90 probe; CONMED) is used to clear unnecessary soft tissue to extend working space (Fig 4B). Then, the instruments of the 2 portals are

swapped. The posterolateral and accessory posterolateral portals become working portal and viewing portal, respectively. To gain access to medial gutter with these 2 portals, the elbow must be extended during working. The posterolateral and accessory posterolateral portals can be interchangeably used for working and viewing. Next, the working space is proceeded to the olecranon fossa area and then lateral gutter, subsequently. Working in the lateral gutter, there is a potential jamming of arthroscopic camera tip and operating instrument because both are in the same direction of the lateral side of elbow. This can be solved by arranging the arthroscopic camera tip proximally and the operating instrument distally. The tip of operating instrument will stay in front of the camera tip. In this case, plica is debrided in the posterolateral gutter using the accessory posterolateral portal for viewing and posterolateral portal for working (Fig 5). Next, if deeper

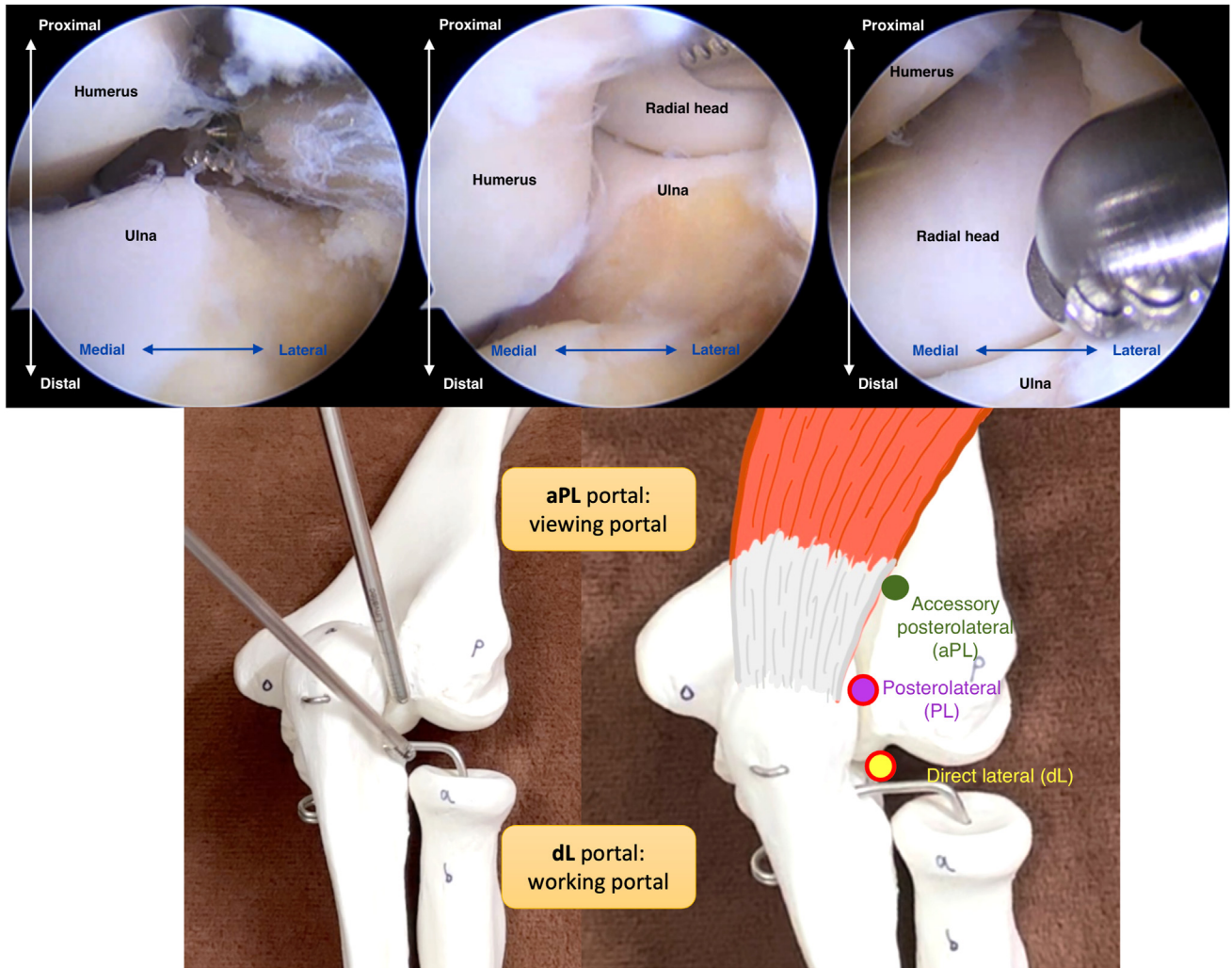


Fig 6. Posterior compartment. If deeper access is needed for resection of lateral and posterior plica, the viewing portal is changed from the accessory posterolateral portal to the posterolateral portal then direct lateral portal is created for working portal. Direct lateral portal is a soft-spot portal that stays between the lateral epicondyle, olecranon tip, and radial head. At this setting, plica can be easily resected at area of posterior radiocapitellar joint. Working is easier with elbow extended. (aPL, accessory posterolateral; dL, direct lateral.)

access is needed for resection of lateral and posterior plica, the viewing portal is changed from the accessory posterolateral portal to the posterolateral portal then a direct lateral portal is created for working portal. A direct lateral portal is a soft-spot portal that stays between lateral epicondyle, olecranon tip, and radial head. At this setting, plica can be easily resected at area of posterior radiocapitellar joint (Fig 6). Working is easier with elbow extended.

After finishing the debridement procedure, the posterolateral rotatory instability of elbow is checked. Viewing from posterolateral portal, a probe coming from direct lateral portal is used to measure the ulno-humeral gap during forceful supination of forearm and full extension of elbow. A widening gap of more than 2 mm indicates a presence of posterolateral rotatory instability (Fig 7 A and B). In conclusion, the portals that are used in posterior compartment are accessory

posterolateral, posterolateral, and direct lateral portals (Fig 8).

Postoperative Care and Rehabilitation

During the first 2 weeks after the surgery, attention is put on the reducing edema. The elbow is advised to be placed higher than the level of heart and is extended in comfortable angle. An arm sling is not used. Immediate postoperative active range of motion is encouraged (Fig 9). After the pain subsides, the patient is allowed to perform normal daily life activities.

Discussion

The main advantage of not using direct posterior portal is the pain-free of triceps brachii postoperatively and so can possibly lead to faster rehabilitation and recovery. This can lead to faster reduction of joint swelling and so reduces the probability of future joint

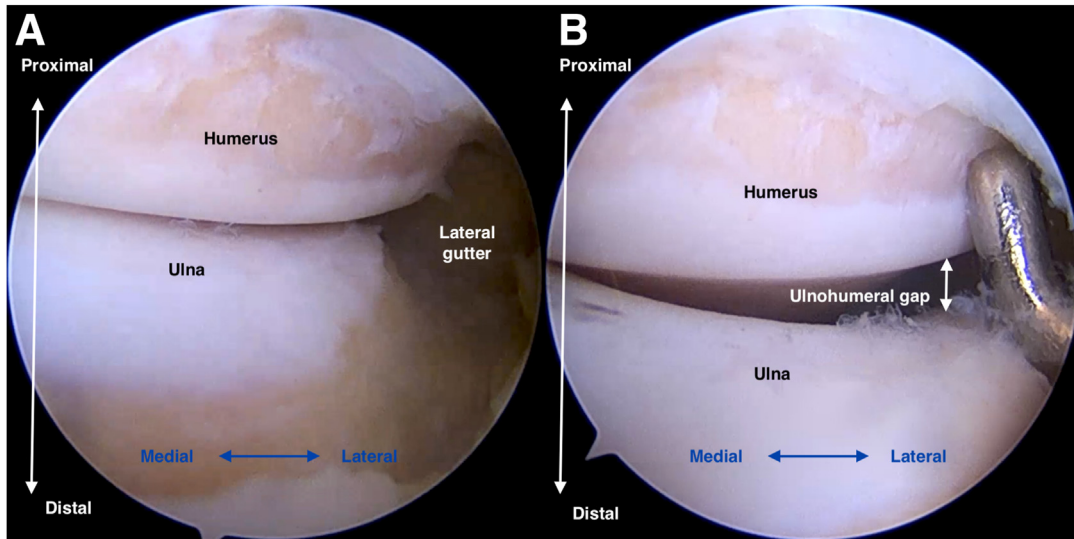


Fig 7. Intraoperative examination of posterolateral rotatory instability (PLRI). Looking from posterolateral portal, (B) probe from direct lateral portal is used to measure an ulnohumeral gap during forceful supination of forearm and full extension of elbow. The tip of the probe is approximately 4 mm. In this case, the gap is less than half of the tip. (Widening gap >2 mm indicates a presence of PLRI.)

stiffness. Moreover, sparing the direct posterior portal can also avoid the wound sensation problem with scar formation. Even though direct posterior portal is commonly used for the posteromedial gutter, accessory posterolateral can do this job as well with elbow extended.

A disadvantage of this technique is the requirement of skilled experience in performing arthroscopy in the elbow. The principle of triangulation cannot be used in this technique because all the viewing and working

portals are on the same side, which is the lateral side. The arthroscopic tip and operating instrument would be almost parallel to each other in the joint. Therefore, another principle of technique is used. The arthroscopic tip and operating instrument should be placed and arranged well on the portals and in the joint. The viewing portal should be more proximal than the working portal. In this setting, the operating instrument can be seen in front of the camera while working in the joint. For example, the accessory posterolateral

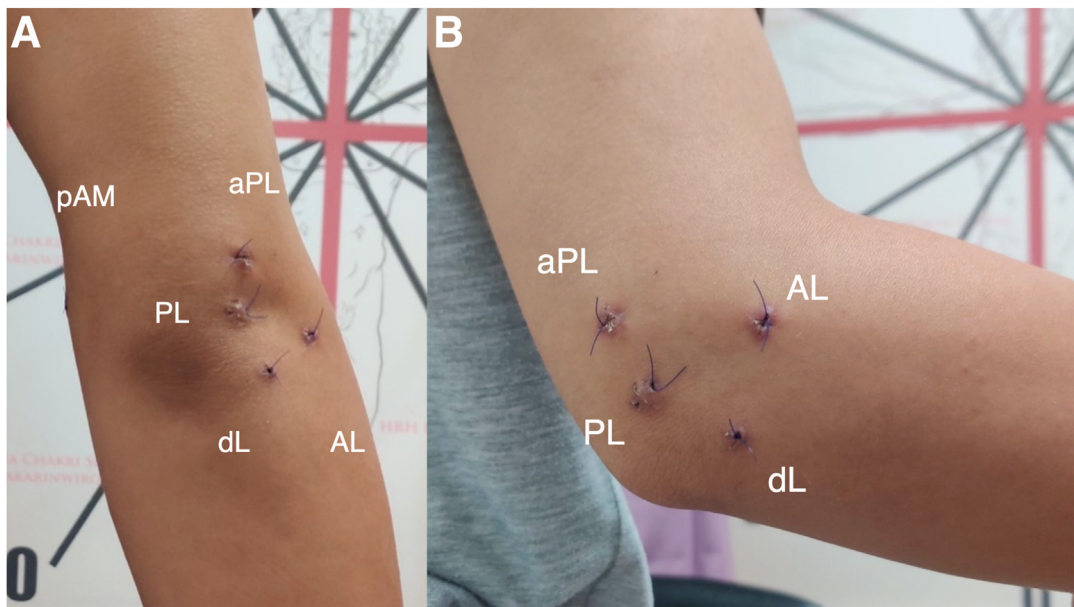


Fig 8. Looking at (A) posterior and (B) lateral aspect of elbow, the picture illustrated that direct portal was spared. The portals used were proximal anteromedial (pAM), anterolateral (AL), accessory posterolateral (aPL), posterolateral (PL), and direct lateral (dL) portals.

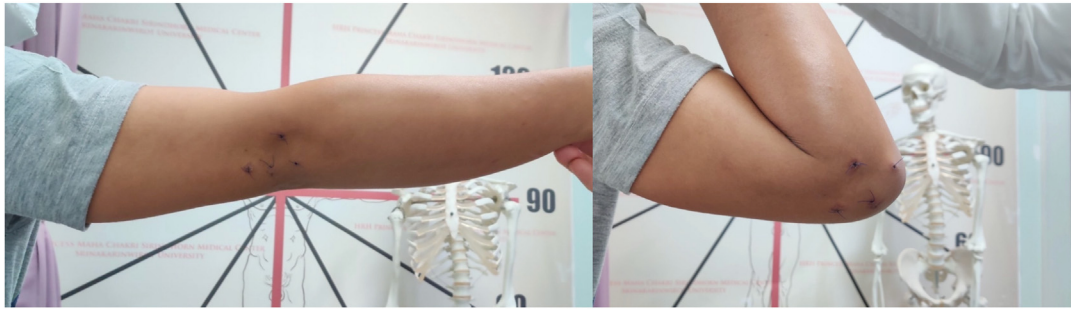


Fig 9. At postoperative 2 weeks, physical examination showed full extension and flexion of the elbow.

Table 1. Advantages and Disadvantages of Sparing the Direct Posterior Portal

Advantages
<ul style="list-style-type: none"> • Postoperative pain-free of triceps tendon for rehabilitation during recovery
Disadvantages
<ul style="list-style-type: none"> • Requirement of skilled experience in performing arthroscopy in elbow

Table 2. Pearls and Pitfalls

Pearls	Pitfalls
<ul style="list-style-type: none"> • The arthroscopic camera tip should be proximal to the operating instrument. • Using the accessory posterolateral and posterolateral portals, interchangeably, in viewing and working of the medial gutter, the elbow must be extended for an adequate access. • After extending working space, work on bone first and then on soft tissue¹⁶ (e.g. osteoplasty then capsulectomy) 	<ul style="list-style-type: none"> • The principle of triangulation cannot be used in this technique at lateral gutter area. • Working in narrow elbow joint can be difficult when working space is not extended adequately.

portal is the viewing portal whereas the posterolateral portal is working portal. The posterolateral portal is the viewing portal whereas the direct lateral portal is the working portal. Advantage and disadvantage are summarized in Table 1. Pearls and pitfalls are summarized in Table 2.¹⁶

In conclusion, using a direct posterior portal can injure the triceps brachii, which is responsible for extensor mechanism. This can degrade the performance on rehabilitation during recovery and possible portal wound sensation with scar formation. This can be prevented by using an accessory posterolateral portal instead of the direct posterior portal, while still being able to manage pathologies in all the area of the posterior compartment.

References

1. Ahmad CS, Vitale MA. Elbow arthroscopy: Setup, portal placement, and simple procedures. *Instru Course Lect* 2011;60:171-180.
2. Adolfsson L. Arthroscopy of the elbow joint: A cadaveric study of portal placement. *J Shoulder Elbow Surg* 1994;3: 53-61.
3. Andrews JR, Carson WG. Arthroscopy of the elbow. *Arthroscopy* 1985;1:97-107.
4. Baker CL Jr. Normal arthroscopic anatomy of the anatomy of the elbow: Prone technique. In: McGinty JB, Burkhart SS, Jackson RW, Johnson DH, Richmond JC, eds. *Operative arthroscopy*. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2003;683-691.
5. Baker CL Jr, Jones GL. Arthroscopy of the elbow. *Am J Sports Med* 1999;27:2512-2564.
6. Chanlalit C. *Elbow arthroscopy and related topics*. Bangkok (TH): Darnsutha Press, 2019.
7. Coleman SH, Altchek DW. Arthroscopy and the thrower’s elbow. In: Green DP, Hotchkiss RM, Wolfe SW, eds. *Green’s operative hand surgery*. 5th ed. Philadelphia, PA: Elsevier, 2005;959-972.
8. Yamaguchi K, Tashjian RZ. Setup and portals. In: Yamaguchi K, King GJ, McKee MD, O’Driscoll SW, eds. *Advanced reconstruction elbow*. Rosemont, IL: American Academy of Orthopaedic Surgeons, 2007;3-11.
9. de Klerk HH, Verweij LPE, Siersevelt IN, et al. Wide range in complication rates following elbow arthroscopy in adult and pediatric patients: A systematic review [published online May 3, 2023]. *Arthroscopy*. <https://doi.10.1016/j.arthro.2023.04.015>.
10. Barco R, Sánchez P, Morrey ME, Morrey BF, Sánchez-Sotelo J. The distal triceps tendon insertional anatomy—implications for surgery. *JSES Open Access* 2017;1: 98-103.
11. Keener JD, Chafik D, Kim HM, Galatz LM, Yamaguchi K. Insertional anatomy of the triceps brachii tendon. *J Shoulder Elbow Surg* 2010;19:399-405.
12. Kholinne E, Zulkarnain RF, Sun YC, Lim S, Chun JM, Jeon IH. The different role of each head of the triceps brachii muscle in elbow extension. *Acta Orthop Traumatol Turc* 2018;52:201-205.
13. Wegmann S, Rausch V, Hackl M, et al. Anatomic evaluation of the triceps tendon insertion at the proximal olecranon regarding placement of fracture fixation devices. *Surg Radiol Anat* 2022;44:627-634.

14. Singh VR, Bain GI. Endoscopic extrabursal excision of olecranon spur. *Arthrosc Tech* 2018;7:e893-e898.
15. Ng T, Rush LN, Savoie FH 3rd. Arthroscopic distal triceps repair. *Arthrosc Tech* 2016;5:e941-e945.
16. O'Driscoll SW. Arthroscopic osteocapsular arthroplasty. In: Yamaguchi K, King GJ, McKee MD, O'Driscoll SW, eds. *Advanced reconstruction elbow*. Rosemont, IL: American Academy of Orthopaedic Surgeons, 2007;59-68.