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Ultrasound in Emergency Medicine

POINT-OF-CARE ULTRASOUND: SONOGRAPHIC POSTERIOR FAT PAD SIGN: A CASE REPORT AND BRIEF LITERATURE REVIEW

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☐ **Abstract—Background: Diagnosis of elbow fracture can sometimes be difficult with plain radiography due to overlapping bones, growth plates, and maturing bones in the pediatric population. The radiographic posterior fat pad (PFP) sign is one of the frequently referenced indirect signs of an occult elbow fracture. This sign can be falsely negative if the sign is subtle, and can be falsely positive when the position of the elbow is not flexed at 90 degrees. Case Report: We discuss a case in which sonographic PFP sign helped to diagnose an elbow fracture. A 57-year-old female presented to the emergency department (ED) after a fall on an outstretched hand. The point-of-care ultrasound (POCUS) was completed identifying an elevated PFP and an anechoic joint fluid collection with innumerous floating hyperechogenic spicules visualized in the olecranon fossa. Diagnosis of a radial head fracture was later confirmed by plain radiograph. Why Should an Emergency Physician Be Aware of This?: The increase in use and availability of POCUS in the ED makes this a very practical application. Our ability to rapidly perform the ultrasound of the elbow may allow us a more rapid diagnosis of pathology, as well as provide a way to further triage our patients. With time, it may even allow us to avoid routine use of plain radiography.**

☐ **Keywords—POCUS; posterior fat pad**

INTRODUCTION

The elbow is a "hinge joint contained within a fibrous capsule" lined by the synovial membrane (1). Three small deposits of fat rest within the radial, coronoid, and olecranon fossa, establishing the fat pads of the elbow (1). These fat pads are described as both intracapsular and extrasynovial. Displacement of these fats pads occurs with distension of the joint capsule. The posterior fat pad (PFP) is located within in the olecranon fossa, bordered by the triceps tendon and anconeus muscle (2). The radiographic PFP sign was first described by Dr. Norell in 1954 (3). The radiographic PFP sign is described as an "elevated posterior lucency on a true lateral radiograph of an elbow flexed at 90 degrees." The elevation of the PFP occurs secondary to distension of the joint capsule. This displacement from the joint effusion may have multiple etiologies, included but not limited to trauma, infection, inflammation, or neoplasm (4–6).

One cadaveric study in 1998 demonstrated that ultrasound is a good modality to accurately identify elbow joint effusions (7). In the study, investigators used three cadavers and injected saline solution at incremental doses ranging from 1 to 15 mL into the elbow joint. This study revealed lateral radiographs identified elbow effusion with a positive PFP sign with 5 to 10 mL of fluid in the joint with the elbow flexed in the 90-degree position. Ultrasonography allowed for identification of as little as 1 to 3 mL of fluid posteriorly with the elbow flexed position and magnetic resonance imaging allowed identification of 1 mL of fluid, regardless of joint position and location. The resolution and clarity of ultrasound technology has advanced over time, and identification of low-volume

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elbow joint effusions by current ultrasonography should likely be less than what was identified at that time. It is important that the elbow be evaluated in the flexed position because in extension, the triceps muscle relaxes and allows the posterior capsule to move freely (5). This laxity causes normal displacement of the PFP within the olecranon fossa. This normal PFP with the elbow in extension must be understood to ensure that clinicians do not erroneously identify this sign as a finding of occult joint disease (5).

CASE REPORT

A 57-year-old female schoolteacher with medical history significant for only hyperlipidemia presented with left elbow pain for 2 days. The patient reported a slip and fall on an outstretched hand while cleaning at home. The patient was right-hand dominant. Vital signs were all normal, and the patient endorsed 7/10 on a pain scale. No gross deformity or ecchymosis was noted on physical examination. There was tenderness in the lateral posterior aspect of left elbow. Minimal fluctuance was palpable in the posterior aspect of the elbow. The range of motion at the elbow was normal but painful with supination and pronation. There were no neurovascular deficits noted in the injured extremity.

A point-of-care ultrasound (POCUS) examination was performed within the emergency department (ED) with a 5- to 10-MHz linear transducer in both sagittal and transverse views. The left elbow was flexed at 90 degrees while scanning the posterior aspect of the elbow. The POCUS was completed within a few minutes. An elevated PFP and anechoic joint fluid with floating innumerous hyperechogenic spicules were immediately visualized in the olecranon fossa (Figure 1). Approximately 1 h later, plain radiographs of the left elbow revealed nondisplaced intra-articular radial head fracture and PFP sign (Figures 2 and 3). An arm sling was applied, and the patient was discharged from the ED with follow-up arranged at the orthopedic clinic.

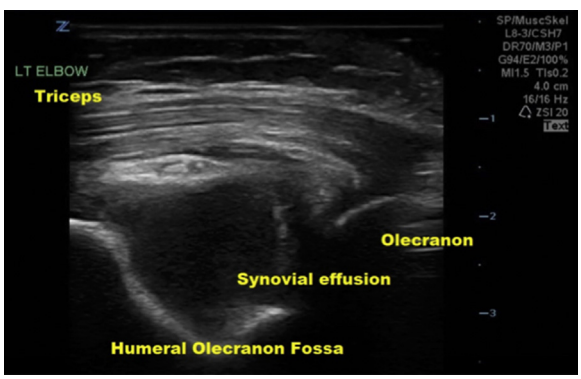

Figure 1. Sonographic posterior fat pad sign in sagittal view at posterior elbow. Synovial effusion seen in humeral olecranon fossa, and displaced posterior fat pad.

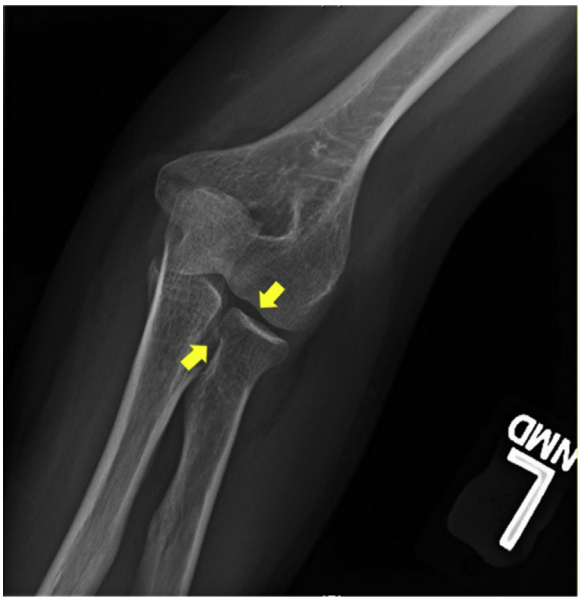

Figure 2. Radiograph elbow anteroposterior view. Arrows showed non-displaced radius head fracture.

DISCUSSION

POCUS is an imaging modality that has repeatedly been proven to be performed successfully by emergency physicians with focused training (8–10). Literature supports the use of musculoskeletal ultrasound examination to diagnose fracture through direct visualization of cortical disruption (11–19). The advantages of POCUS over other imaging modalities have been stated frequently. Clearly, the avoidance of radiation, cost-effectiveness, and availability of use at the time of evaluation cannot be overstated

Figure 3. Radiograph elbow lateral view. An arrow showed posterior fat pad sign.