Traumatic Distal Humeral Hematomas: A Report of 2 Cases

Matthew J. Snyder, MD, B. Matthew Hicks, MD, and Michael Thieken, MD

Muscle injury, contusions, and hematomas are frequent injuries incurred during sports.[1-4] They regularly lead to limitation in activity that oftentimes can be season-long. Hematomas in the quadriceps,[5-13] iliopsoas,[14] and gastrocnemius musculatures[15,16] have been well described. Hematomas can be secondary to trauma and can occur spontaneously. Many, but not all, of the patients who report with spontaneous, and even traumatic, hematomas that lead to surgical intervention may have an underlying bleeding or clotting disorder (genetic or iatrogenic).

In this report of 2 isolated cases, we describe the presentation and course of 2 blunt traumatic distal humeral perimuscular and intramuscular hematomas in healthy, adolescent football players. In-depth hematologic workup for bleeding disorders or dyscrasias was not performed as neither player had a personal or family history of prior hematomas or abnormal bleeding disorders upon presentation.

Dr. Snyder is Chief Resident, and Dr. Hicks is Program Director, Fort Wayne Medical Education Program, Orthopaedic Surgery Residency, Fort Wayne, Indiana. Dr. Thieken is Sports Medicine and Arthoscopy Fellow, New Mexico Orthopaedics, Albuquerque, New Mexico.

Address correspondence to: Matthew J. Snyder, MD, Orthopaedic Surgery Residency, Fort Wayne Medical Education Program, 2448 Lake Ave, Fort Wayne, IN 46805 (tel, 260-312-8041; fax, 260-918-3114; e-mail, mjsnyder@comcast.net).

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The literature suggests that most muscle injuries are self-limited and improve with conservative treatment. No case reports or studies (to our knowledge) in our literature review have reported such limitations in elbow function and brisk improvement following surgical intervention.

The authors have obtained the patient's guardian's written informed consent for print and electronic publication of case report 1 and the patient's written informed consent for print and electronic publication of case report 2.

> "We believe that hematomas adjacent to the elbow should be followed closely and with caution owing to the long-term consequences of immobility."

Case Report 1

A 16-year-old male high-school football player presented to the outpatient orthopedic surgery office for evaluation of right elbow pain. He took a direct blow during a tackle 15 days prior to presentation. He had progressive inability to flex and extend his elbow. His pain was focalized to the distal anterolateral aspect of the humerus. Treatment prior to presentation consisted of ice, compression, and intermittent acetaminophen. Intermittent ibuprofen was used only after presentation to the clinic. His ability to participate in football was limited.

The patient's physical examination on presentation showed obvious focalized anterolateral swelling over the distal aspect of the biceps and brachialis muscles. His active range of motion was -80° extension to 120° of flexion at the elbow. Shoulder, forearm, and wrist range of motion were unrestricted and symmetric to the opposite side. Motor testing showed weakness in the elbow flexion estimated at 4/5. All other upper extremity motors were symmetric. No neurological findings were noted. The biceps tendon was palpable and felt to be intact, though examination was difficult secondary to limitations in motion and pain. No evidence of compartment syndrome was noted. Limited ligamentous testing showed no instability. Vascular status was normal and symmetric. No other stigmata of bleeding disorders or dyscrasias were identified. Elbow radiographs were unremarkable for bony injury or soft-tissue abnormalities. No elbow effusion was evident.

Because of the patient's progression, severe limitation in motion, and disability, he was further evaluated via magnetic resonance imaging (MRI). A routine elbow imaging protocol had to be modified owing to range-of-motion restrictions. The imaging study showed a loculated fluid collection with fine linear septations measuring 8.5×3×2.5 cm posterolaterally adjacent to the biceps muscle. The biceps muscle was also edematous. Brachialis muscle injury with overlying hematoma or seroma was the interpretation. No evidence of tendon rupture was found. MRIs are shown in Figures 1A-1D.

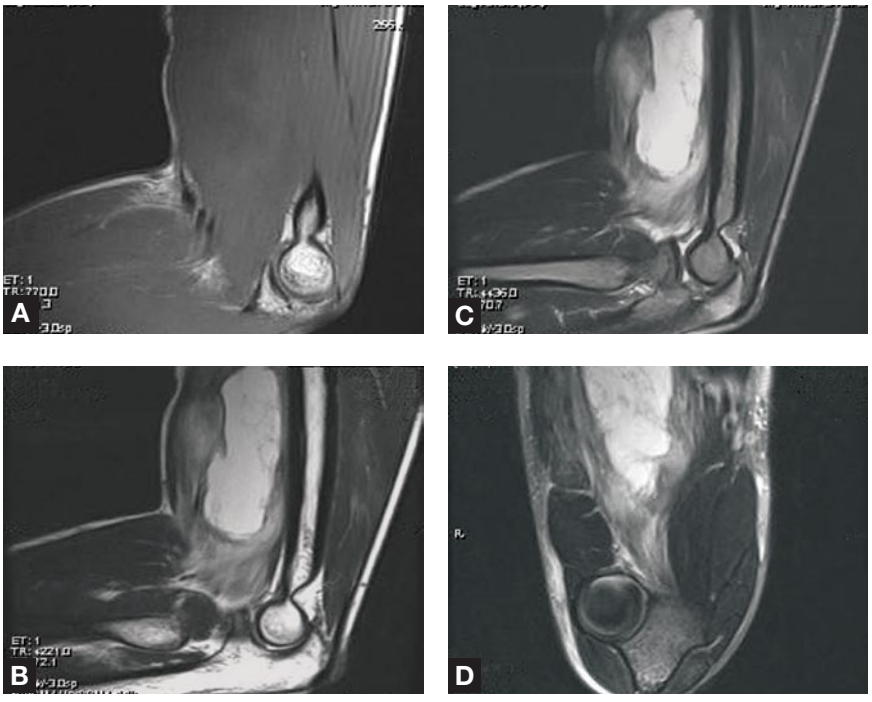

Figure 1. Case 1—Magnetic resonance imaging shows overall low signal with a few scattered areas of intermediate signal in the T_1-weighted images with little outline of the hematoma. The T_2-weighted images show a well-circumscribed but partially loculated lesion 8.5×3×2.5 cm with high-signal intensity consistent with fluid. Slight stranding within the lesion is of intermediate density. Areas of intrabrachialis muscle edema are also evident. Images are as follows: (A) coronal presaturation T_1-weighted image, (B) coronal fast spin–echo T_2-weighted image, (C) coronal fat-saturated T_2-weighted image, and (D) sagittal fat-saturated T_2-weighted image.

Because of these findings and the patient's lack of improvement over a 4-week period, he was scheduled for an ultrasound-guided aspiration 23 days after initial injury. The mass showed evidence of organized hematoma, and the aspiration was aborted owing to solid hematoma within the biceps musculature.

The patient's limitations persisted despite nonoperative management. Surgical evacuation with manipulation was recommended and performed on day 28. A 4-cm anterolateral incision was made over the distal aspect of the humerus, and a tourniquet was used. The lateral aspect of biceps was approached and an organized intramuscular hematoma was identified in the lateral aspect of the brachialis muscle. We evacuated 100 cm^3 of bloody fluid and clot. Cultures were taken and were negative. After evacuation, the patient's passive elbow extension improved to -60°. Manipulation improved his extension to -10°. At the conclusion of the procedure, the tourniquet was deflated, and no evidence of arterial or high-volume venous bleed was identified. The arm was splinted in extension for 2 days, and active and passive range-of-motion exercises were initiated in a formal physical therapy program. The splint was used only at night until pain and spasms resolved. No evidence of excessive bleeding was identified at any follow-up interval. At 3-week follow-up, his active range of motion was 0° of extension to 140° of flexion. Passive range of motion was 2° of hyperextension to 152° of flexion. His strength was measured at 80% of his opposite side by 3 weeks. He subsequently returned to football with no ill effects at 1 month postsurgery.

Case Report 2

An 18-year-old football player presented to the clinic 3 days after sustaining a direct blow to his right anterolateral distal humerus. He was able to complete the game but had progressive swelling and limitation of motion during the next 2 days. Initial treatment consisted of only ice and compression with minimal relief. NSAIDs or acetaminophen were not used.

Examination showed a palpable and focal mass with tenderness over the anterolateral aspect of the distal humerus adjacent to the brachioradialis insertion proximally. Overlying ecchymosis was present. The elbow joint was without evidence of effusion. Ligamentous testing was without instability. The patient's active range of motion was -55° extension to 130° of flexion at the elbow. Passive elbow motion showed limitation to -45° of extension. Pronation and supination were full and symmetric actively and passively. Strength testing showed weakness in elbow flexion estimated at 5-/5. Resisted elbow flexion and forearm supination were 5-/5 but without pain or palpable defect over the biceps muscle belly or tendon distally. Shoulder, forearm, wrist, and hand strength were unaffected. Neurovascular exam was normal. No signs, symptoms, or clinical findings of compartment syndrome were evident. No stigmata of bleeding disorders or dyscrasias were identified. Elbow radiographs were unremarkable for bony injury or soft-tissue abnormalities.

Treatment after initial orthopedic evaluation consisted of physical therapy and an anti-inflammatory medication. Phonophoresis, moist heat, soft-tissue mobilizations, and range-of-motion exercises were continued for several days. A nighttime extension splint was also used. After 3 days of physical therapy, the patient showed no improvement of pain or range of motion. His extension worsened to -75° after 5 days from initial injury. Biceps strength remained 5-/5. Because his motion had worsened so quickly and progressively despite conservative measures, MRIs were obtained.

Routine imaging sequences were obtained. Results showed a 5.0×2.5 ×2.7 cm subacute hematoma inter-

posed between the lateral margin of the brachialis and deep lateral aspect of the brachioradialis. No occult fractures or vascular malformations were identified. The biceps tendon was intact down to the radial tuberosity. Images are shown in Figures 2A-2D.

Because of the patient's significant limitation in motion and lack of clinical improvement, options were discussed with the patient and family. Surgical evacuation and manipulation of the elbow was recommended. Surgery was performed 18 days after initial injury. Just prior to anesthesia, active range of motion was 55° (Figure 3A). Examination under anesthesia showed passive extension at the elbow to -45° (Figure 3B). Flexion was recorded at 145° (Figure 3C). A 5-cm incision was made over the anterolateral aspect of the distal humerus, and a tourniquet was used. The biceps was retracted medially. The superficial lateral aspect of the brachialis was split, and the hematoma was identified and evacuated within the muscle fibers. It was still partially fluid with areas of firm, gelatinous clot. The tourniquet was deflated and no arterial or venous bleeders of significance were identified. Motion improved with manipulation of the elbow to -15° extension (Figure 3D). An extension splint was applied. Physical therapy was reinitiated on postoperative day 3 for range-of-motion exercises. By postoperative day 9, the patient's active range of motion had improved to -5° extension to 140° flexion at the elbow. The patient had returned to full activity by 4 weeks postsurgery without limitations in function or strength. No evidence of excessive bleeding was identified at any follow-up interval.

Discussion

Muscular hematomas have been well described as common sports injuries. Their treatment and the science behind it are much less described. Many reports have been made on quadriceps,[5-12,17] gastrocnemius,[1,15] and illiopsoas[14] hematomas. Quadriceps hematomas and contusions have been best described in the literature as a result of their high incidence in contact sports, particularly in American football, rugby, and Australian rules football.[2,18-20] Numerous case reports also show that compartment syndrome can be a complication of moderate to severe blunt-force trauma.[6,12,17] Though the hematomas described in our cases were traumatic, there are many reports of atraumatic or spontaneous[1,9,15] and chronic-expanding hematomas.[8,21,22] In addition, there are many reports of subacute and chronic hematomas mimicking soft-tissue neoplasm.[8,22-25] These atypical hematomas are often recurrent, expanding, and chronic, and they often present with unusual radiological findings. These findings would lead to a different approach to treatment from the onset of presentation in comparison with our cases. The diagnosis of hematoma in our 2 cases was relatively straightforward with a positive history of blunt-force trauma and no suspicion of familial or iatrogenic clotting disorders. In addition, MRI findings were consistent with the history in our cases.

"MRI has also been recommended as a good diagnostic tool for identifying hematomas because it shows fluid and soft-tissue signals."

Diagnosis can be challenging if the history is not direct, as demonstrated in the literature. Several radiographic modalities have been used to assist in decision making. Ultrasound has been described as a good, initial diagnostic modality.[26,27]

Aspelin and colleagues[26] have categorized traumatic muscular hematomas into 3 categories: circumscribed

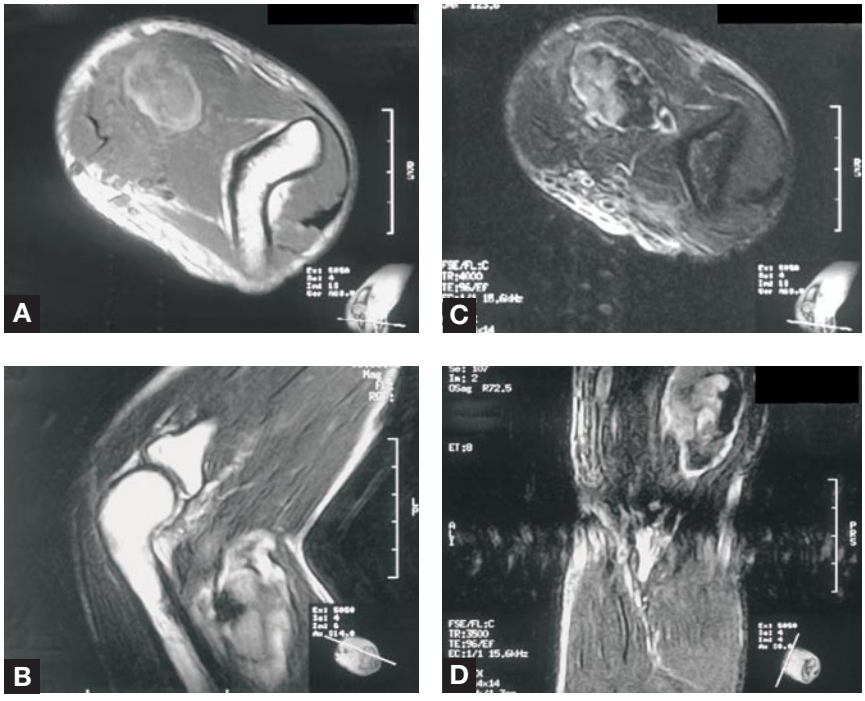

Figure 2. Case 2—Magnetic resonance imaging shows a heterogenous soft-tissue mass with areas of mixed signal in both T_1- and T_2-weighted images. The hematoma measured 5.0×2.5×2.7 cm in greatest dimensions. (A) axial T_1-weighted image, (B) coronal T_1-weighted image, (C) axial fat-suppression T_2-weighted image, and (D) sagittal fat-suppression T_2-weighted image.

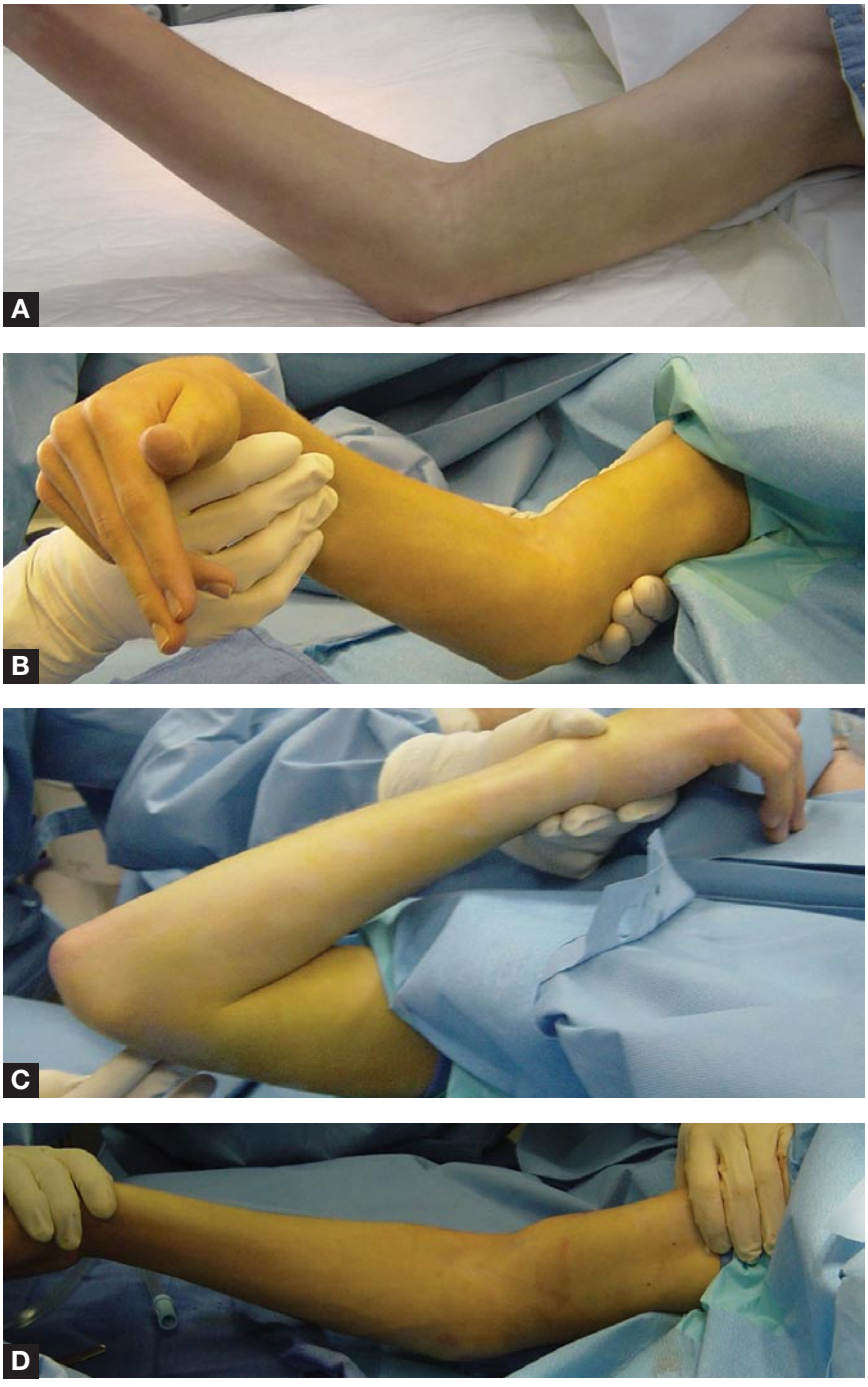

Figure 3. Case 2—Intraoperative images show: (A) preoperative active elbow extension, (B) passive extension under anesthetic, (C) passive flexion under anesthetic, and (D) passive extension after evacuation of the hematoma and manipulation of the elbow joint.

liquefied hematoma, circumscribed nonliquefied hematoma, and diffuse lesions. With these categories, they propose a specific surgical option for each. For circumscribed, liquefied hematomas, they propose percutaneous drainage. For circumscribed, nonliquefied hematoma and diffuse lesions, they recommend a more invasive approach. With the diffuse lesion, the concern is that compartment syndrome and fasciotomy may be required. In our case 1, the circumscribed, nonliquefied hematoma was identified and required eventual open evacuation. It is certainly possible based on the MRI findings in case 2 that if an ultrasound were obtained, a less invasive, percutaneous evacuation would have been feasible and potentially successful, with fluid mainly evident initially.

MRI has also been recommended as a good diagnostic tool for identifying hematomas because it shows fluid and soft-tissue signals.[8,9,16,21,26] Findings depend on timing in these situations.[16] Hoffman and colleagues[16] note that, generally, prior to organization of a hematoma, high signal on T_2-weighted images and low signal on T_1-weighted images are present. With further organization of the hematoma, the signal intensities reverse. This is felt to be secondary to osmolality and hemoglobin and methemoglobin concentration along with a diminished pH.[16] In transition, with recurrent injury, or with repeat bleeding, the appearance of signals can be mixed, similar to many malignant neoplasms.[8,21,22,28] This is a concerning problem and more diligence is needed in the diagnostic and therapeutic decision making. In our cases, MRI helped delineate the masses, narrow our differential diagnosis, and plan a surgical approach. Technetium-99m pyrophosphate muscle imaging has also been used to delineate subcutaneous hematomas but is not well described in the literature and less clinically available.[29]

Enlarging hematomas have been described in relation to hemophilia, factor deficiencies, and Von Willebrand disease.[10,13] The specific location of the hematomas in our cases has been described indirectly in only one study to our knowledge, relating enlarging hematomas and subtle Factor XIII deficiency.[13] No clinical or outcome parameters were given other than localized pain and a growing mass in the biceps brachii as the presenting complaint. This case was part of a series and stated only that the symptoms decreased within 3 months. No treatment specifics were given.

We are not aware of a case report in this anatomic location with unique and drastic clinical findings, specifically, limitation of passive range of

motion. On the other hand, it has been well published that quadriceps strain and contusion severity can be partially based on motion ≤90° at the knee (eg, limitation of range of motion to <90° is severe).[7] This has led to an initial treatment recommendation in severe contusions, strains, and hematomas of the anterior or anterolateral thigh to place the knee in a flexed position in the acute period to maintain the muscle belly on stretch.[7] One could apply this recommendation to the elbow directly (and any other joint) with a caveat noting the natural reaction of the specific joint to long-term limitation in motion. Graham[4] described hematomas as either intermuscular or intramuscular. Intermuscular hematomas showed diffuse swelling with rapid resolution and minimal limitation in function. He described intramuscular hematomas as localized with pain secondary to containment in the muscle belly. This type was felt to have loss of voluntary contraction, intense pain with passive stretch, and a much longer time for recovery in comparison with intermuscular hematomas.[4]

Conclusions

While most orthopedic surgeons, sports medicine physicians, and primary care physicians would initially treat a traumatic hematoma or contusion nonoperatively (eg, rest, ice, compression, elevation), we believe that the anatomic location described by Graham,[4] severity of limitations, and forgiveness of the nearest joint to long-term immobilization must be considered prior to beginning definitive nonoperative treatment. In addition, the timing of the injury and the clinical and athletic situation of the individual athlete must also be considered in order to assist in definitive treatment of a usually benign process. We believe that hematomas adjacent to the elbow should be followed closely and with caution owing to the long-term consequences of immobility.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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This paper will be judged for the Resident Writer's Award.