CASE REPORT

Traumatic elbow arthrotomy after motorcycle accident not evident on CT

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SUMMARY

An 84-year-old man sustained a motorcycle accident resulting in a left elbow laceration. Orthopaedics was consulted to rule out traumatic arthrotomy. Radiographs and CT of the left elbow showed no acute osseous abnormalities and no evidence of traumatic arthrotomy. The wound was irrigated, dressed and splinted. On follow-up, the patient reported that he had been given clindamycin on a return visit to the emergency department for increased drainage. On inspection, the patient's wound was found sutured and draining purulent fluid. The patient persistently had no pain on axial loading or range of motion since his injury and no evidence of intra-articular air on initial CT. However, given the mechanism of injury, irrigation and debridement (I&D) in the operating room was immediately performed revealing purulent joint fluid and a traumatic arthrotomy. I&D was carried out for the second time in the joint. After an extended hospital stay and antibiotics, the infection resolved.

BACKGROUND

This case presents one of the persistent challenges in orthopaedic traumatology, namely, the detection of a hidden traumatic arthrotomy (TA). Undiagnosed TA can directly inoculate the joint space with invasive pathogens resulting in significant morbidity and mortality in patients. Historical studies from World War II reported infection rates up to 27% for traumatic knee arthrotomies managed non-operatively.¹ Current standard of care for TA is operative irrigation and debridement (I&D) followed by antibiotics.² Soft tissue injuries not penetrating the joint are managed with I&D either bedside or in the operating room depending on the severity.

Several modalities can be used to diagnose TA. These are CT scan,² saline load tests (SLTs)^{3–6} and SLT with methylene blue.⁷ CT scan sensitivity and specificity for detecting TA with intra-articular air has been reported at 100% in other joints and has largely replaced the SLT.³ In this case, the CT scan was read as negative for intra-articular air by both the radiologist and the orthopaedic surgeon. A SLT was not performed. The patient later developed a septic elbow requiring two I&D surgeries, an extended hospital stay, and a lengthy course of intravenous and oral antibiotics. It may have been possible in this case to have avoided the complications by performing an SLT to detect the TA that was not evident on CT by intra-articular air. This

is the first report that we know of where a TA was missed by CT due to a lack of intra-articular air in an elbow joint that may have been detected by a SLT and later became septic.

Literature concerning detection of TAs in elbow joints is sparse. It is our hope to add to the available literature and to increase awareness that TAs may occur without introducing air into the joint making them very difficult, if not impossible, to detect on CT. In cases where clinical suspicion is high or even ambivalent, a bedside SLT may detect an occult TA missed by CT.

CASE PRESENTATION

An 84-year-old man suffered a motorcycle accident while swerving to avoid an accident that occurred in front of him. He rolled off of his motorcycle injuring his left elbow and collided with another vehicle bringing him to a stop. He denied pain to any of his other extremities or loss of consciousness. Orthopaedics was consulted by the emergency department (ED) to evaluate the wound to his left elbow for TA. His prior medical history was significant for hypertension, COPD and osteoarthritis of both knees. He had no known drug or other allergies. He was immunocompetent. Prior surgical history consisted of bilateral carpal tunnel and Dupuytren's releases. He was retired, reported occasional social alcohol use and denied any tobacco or illicit drug use. On focused physical examination, he had a 6-cm curvilinear laceration to his left elbow laterally that extended down to the muscular fascia with accompanying ecchymosis with minimal contamination. He noted minimal but tolerable pain to range of motion (ROM) of the left elbow with active and passive movement but no pain on axial loading. The left arm was neurovascularly intact distal to the laceration. He denied pain with active and passive ROM of the left wrist and shoulder and the remainder of his joints from his normal baseline.

INVESTIGATIONS

Radiographs of the left elbow, right hand and pelvis were reviewed and found to be without acute osseous abnormality (figure 1). Chest X-ray revealed a left pleural effusion.

CT of the chest, abdomen and pelvis revealed a left pleural effusion possibly pulmonary contusion

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Figure 1 Left elbow lateral radiograph.

with chronic lung disease, but no abdominal or pelvic pathology. A CT scan of the left elbow was obtained and notable for no evidence of air in the joint or acute osseous abnormality (figures 2 and 3). Laboratory results revealed a lactate of 2.9. Complete blood count (CBC) and comprehensive metabolic panel (CMP) were unremarkable.

Figure 2 Left elbow sagittal CT.

Figure 3 Left elbow anteroposterior CT.

DIFFERENTIAL DIAGNOSIS

Differential at the time of his injury included a TA versus a superficial laceration.

TREATMENT

The patient was admitted by the trauma team for observation of pulmonary contusion. Prior to admission, the elbow laceration was treated in the emergency department with a bedside irrigation and debridement. Local anaesthetic was used, and the wound was irrigated with normal saline and inspected to ensure there was no debris or necrotic tissue. Following irrigation, the wound was loosely approximated with nylon sutures in an interrupted fashion. Through his hospital course, he remained afebrile and without leucocytosis. He had mild, resolving drainage from the lateral wound but only minimal pain on ROM of the elbow and no pain with axial loading of the joint. There was no swelling or erythema at the laceration, but minimal erythema on the medial aspect of the elbow. He was discharged home on hospital day 4 with follow-up scheduled in the orthopaedic clinic in 1 week.

OUTCOME AND FOLLOW-UP

Prior to his scheduled visit with orthopaedics, the patient reported that he had again presented to the ED for increased drainage from his wound. Orthopaedics was not notified at that time. He was found by the ED to have an elevated C reactive protein (CRP) at 10.56 mg/L (normal 0–0.5 mg/L). In addition, he noted occasional, needle-like pain in his arm radiating from the elbow. He was placed on oral clindamycin by the ED at that time, with improvement in his drainage. He denied fevers, chills,

cough or other constitutional symptoms. He denied limitation to ROM except for that imposed by his splint.

On follow-up in orthopaedics, examination of his left elbow revealed significant purulent drainage, surrounding erythema and mild fluctuance. There was no pain with axial loading and ROM from 5° to 120°. Sensation was intact in the median, radial and ulnar nerve distributions. The patient was taken immediately to the operating room.

Laboratories at follow-up revealed a normal white cell count (WCC) at $8.5 \times 10^9/L$ but elevated erythrocyte sedimentation rate at 82 (0–10) and CRP at 3.67 (0–0.5) mg/L.

Arthrocentesis was performed prior to incision and was yellow and cloudy. It was sent for cell count and cultures. The existing sutures were removed from the wound and the wound bed was cultured. The wound bed was then explored and a linear TA of approximately 3 cm in length was discovered that extended into the radiocapitellar joint. The joint cartilage was found to be healthy. The joint was irrigated and the devitalised tissue of the wound bed was debrided. A Penrose drain was inserted and the irrigation and debridement (I&D) was repeated 2 days later and no devitalised tissue was found. After the second I&D, the wound was closed over a drain. Laboratories were trended throughout his hospital stay and cultures were followed. His arthrocentesis was notable for WCC of $35 \times 10^9/L$ with 97% polymorphonuclear cells. There were no organisms on Gram stain and no growth on cultures from the joint after 5 days. In contrast, cultures from his exterior wound grew Gram-negative rods and Zosyn was added for improved coverage. Following speciation (*Enterobacter cloacae*), his antibiotics were tapered to ertapenem. He remained without a leucocytosis and with improvement in CRP to normal levels at time of discharge on hospital day 9. He was discharged on intravenous antibiotics for 2 weeks with an additional 2-week course of fluoroquinolones under the direction of infectious disease. He completed his antibiotics uneventfully. At 7-month follow-up, the patient was fully recovered with a Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) score of 14 and Sport component of 50.^{8,9} His reported Patient Satisfaction+ Visual Analogue Scale scores were both 100%.

DISCUSSION

We were unable to find any other case reports in the literature presenting a traumatic elbow arthrotomy missed by CT or SLT. There are no studies or case reports describing the use of MRI, ultrasound or other imaging modalities to assist the surgeon in making the diagnosis of occult TA in the elbow.

Most of the literature concerning TA detection is dedicated to the lower extremities, especially the knee and ankle where most TAs occur. Open wounds of the elbow was the diagnosis in only 3.2% of estimated 150,000 elbow surgeries performed in the USA in 2006.¹⁰ This may explain the sparse literature concerning the diagnosis of TA related to elbow lacerations. In the Voit study (1996), SLT altered the treatment in 40% of cases based on clinical picture, but it was unclear if CT was part of the initial decision even though it was widely available at that time.¹¹

Learning points

- ▶ Occult traumatic arthrotomy (TA) of the elbow joint capsule from trauma may be easily missed by CT if no intra-articular air is introduced.
- ▶ Saline load test (SLT) has historically been used to detect TA and may be a good adjunct for CT even though CT is more sensitive.¹²
- ▶ Given the low predictive value of a SLT in the elbow and lack of literature supporting CT detection, any wound over the elbow joint should be considered a TA until proven otherwise.
- ▶ A missed TA in any joint with overlying soft tissue injury can introduce pathogens into the joint resulting in complications requiring surgical irrigation and debridement, hospital admission and lengthy regimens of antibiotics.
- ▶ There is a fair amount of literature supporting SLT, but most of it is dedicated to the knee and very little is published concerning the elbow or other joints, and more research is needed.

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