A Leg Too Young to Die:
Part 2 of Case Studies in Emergency Department Medical Malpractice Claims

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Learning Objectives

1. Review compartment syndrome along with the medical and legal consequences of failing to diagnose it in a timely manner.

2. Identify the importance of charting the details of a consultation with an on-call specialist.

3. Recall the importance of injury or disease specific discharge instructions in certain high-risk situations.
A 15-year-old male fell off his dirt bike at 1900 hours (7:00 PM) on 9-12-07 and injured his right knee.

EMS arrived on scene at 1915. There was no complaint of head or neck injury or LOC, but the paramedics noted “...severe pain to his right knee and right lower leg.” The physical examination revealed: “He had strong equal exts [extremities?] pulse and was able to move his toes on the injured foot. His cap refill was less than 2 seconds.”

The right leg was splinted, pain medication was administered, and the patient was transported to a nearby, rural hospital.

In route to the hospital, the patient claimed that “...his knee and lower leg were feeling numb but he still had fair sensation.”
Hospital Triage & Nursing Notes

• Initial triage note at 1945: “...R knee and R calf pain... Pedal pulse 2+... Pain level 8 [8/10]... Quality is sharp and dull.”

• Subsequent note and exam by that same nurse: “Patient reports numbness to right leg.” “Pedal pulses present. Brisk capillary refill.” “Color is pink. Temperature is cool. Patient complains of numbness to entire foot.”
Physician Assistant Notes

• The patient was seen by a physician assistant (PA-C) at 2010. “Patient denies ankle pain, foot pain, distal neuro complaints, proximal injury, distal injury.”

• Exam revealed: “No cyanosis, clubbing, calf tenderness...” He does have “…pain, tenderness, deformity at rt knee.” “No focal motor deficits, [no] focal sensory deficits...”

• Patient treated with morphine and Toradol and sent to x-ray for plain film imaging of the pelvis, entire right lower extremity, and other images appropriate for this mechanism of injury. The PA read the knee x-rays as “…fracture noted, to the tibial plateau, to the tibial tuberosity.”
Anatomy of the Knee
Normal Adult Knee, AP View
Normal Adult Knee, Lateral View
Anatomy of Pediatric Bone

Metaphysis

Physis (Epiphyseal plate)

Epiphysis
Normal Pediatric Knee – AP View
Salter-Harris Classification of Fractures in Children
The Injured Knee, AP View
The Injured Knee, AP View Close-up
Salter-Harris Type III Fracture
The Injured Knee, Lateral View
• The attending MD in the ED was consulted by the PA at 2134. The note to document that was “rt leg immobilizer applied. d/w dr. [ED attending].” The attending did not write a note, but he did sign the chart.

• The PA called the on-call orthopedist at 2215 who, because of this rural setting, was not available locally. In fact, the orthopedist was taking call from a Regional Medical Center in a city some 60-miles away.

• Details of that conversation were not recorded except for “…spoke with dr. [ortho on-call] who advises treatment, care, and follow up with him.”

• The final diagnosis was: Fracture, right tibial plateau.²
Final Nursing Notes

• 2147: The same nurse who had previously recorded that the foot was numb and cool, applied a knee immobilizer and fitted the patient with crutches.

• After application of the knee immobilizer, she noted: “Capillary refill less than 2 seconds.” “Distal sensation intact, distal pulses present.” No pain score at the time of discharge was recorded.

• She handed the patient a copy of his x-rays, a Percocet 6-pack to go plus a prescription for Lorcet 10/650 #15, and discharged him from the Emergency Department at 2205 on 9-12-07.
Discharge Instructions

• “If any symptoms develop that cannot be controlled with the prescribed treatment and your doctor is not available, return to the Emergency Department.”

• “I understand what changes to look for and what to do.”

• “Take meds as directed, follow up tomorrow with [the orthopedic doctor in the city – name and phone number provided].” The name and phone number of a local orthopedist was also provided.

• Mom signed all of these instructions.
Follow-Up with the PCP

- The patient was enrolled in an HMO, and Mom was concerned that she could not take her son to the orthopedist without prior authorization by her son’s primary care physician (PCP). Therefore, the patient was seen by his local pediatrician on the morning of 9-13-07.

- The PCP’s exam was charted as: “Peripheral pulses full to palpation...edema of RLE from R knee to foot. Skin temperature of the lower extremities is warm to cool, proximal to distal. ...Gait and station examination reveals limp right. Inspection and palpation of bones, joints and muscles reveals right knee shows evidence of pain on movement and weight bearing. ...muscle strength is 1/5 due to sever [sic] pain.”
Follow-up with the PCP (cont’d)

• At deposition, the PCP said that:
  - She never removed the leg splint or looked at the knee.
  - She felt a dorsalis pedis pulse but not the posterior tibial.
  - The right leg “…was warmer in the knee and it was cooler on the foot.”
  - She did not attempt to move the foot up and down.
  - She did not look at the x-rays.
Follow-Up with the PCP (cont’d)

• Mom stated in her deposition that the pediatrician only looked at her son from across the room, never removed the immobilizer, never examined the leg, and never looked at the x-rays that she had brought with her.

• The pediatrician authorized a consultation with ortho in the city but for the next day rather than for that same day as recommended in the discharge instructions from the Emergency Department.
Orthopedics

• The patient traveled to the city to be seen by an orthopedist on 9-14-07, 2-days after the injury. He was seen by a partner of the orthopedist who had been on call the night of 9-12-07.

• The orthopedist noted that the patient’s pain had been “worse all day.”

• On exam, the right lower leg was found to swollen, tense, pulseless, paralyzed and numb; yet, it was too painful to allow passive range of motion.

• He was sent directly to the hospital and was being operated on within 2-hours.

• At deposition, the operating orthopedic surgeon opined that: “The time of injury was the inciting factor and that this [the compartment syndrome] had been going on since that time.”
Compartment Syndrome
Compartment Syndrome (cont’d)
Compartment Syndrome (cont’d)
Compartment Syndrome (cont’d)
Compartment Syndrome (cont’d)

- The pathophysiology of compartment syndrome is complex but is always related to increased pressure in one or more compartments that causes inadequate tissue perfusion resulting in ischemic necrosis of those tissues.\(^3\)\(^-\)\(^6\) The non-elastic fascia that forms the boundary of a compartment traps increased fluid caused by trauma, bleeding or edema; and the compartment pressure rises. As compartment pressure increases, venous outflow is reduced and venous pressure rises. This leads to a reduction of the arteriovenous pressure gradient and diminished perfusion. Ischemia begins when that gradient falls to a level such that the metabolic demands of the tissues in the compartment can no longer be met.
Compartment Syndrome (cont’d)

- Normal compartment pressure is between 0-8 mmHg.
- Compartment pressure of 30 mmHg or higher is worrisome for the onset of compartment syndrome.
- A compartment pressure reading of within 30 mmHg of the diastolic blood pressure may be a more useful metric to use as the cut-off point for concern regarding compartment syndrome.
- When pressure in a compartment equals or exceeds the diastolic blood pressure, the tissues in that compartment cease to be perfused and will become necrotic.
Compartment Syndrome (cont’d)

Stryker Compartment Pressure Monitor
Compartment Syndrome (cont’d)
Signs & Symptoms

- Pain: particularly, pain out of proportion to the injury
- Pallor: extremity appears blanched or very white with no capillary refill or a prolonged capillary refill time
- Pulselessness: absence of pulses distal to the area of injury. In this case: the dorsalis pedis and posterior tibial pulses
- Poikilothermia: limb is cool or cold to the touch
- Paresthesia: numbness, burning, or tingling sensation
- Paralysis: inability to move the limb
Surgery

• The tibial plateau fracture fragment was unstable and moved back and forth.

• The popliteal artery had been transected by this free-floating fracture fragment, but a clot had formed in the artery which prevented persistent bleeding into the calf. Even the orthopedic surgeon did not anticipate this finding.

• A vascular surgeon was called in to anastomose the transected popliteal artery.

• The muscles and nerves in multiple compartments were already necrotic; and, over time, a series of operations had to be performed to remove necrotic tissue from the various compartments.
ED Knee X-ray (close-up)
Anatomony of the Knee: Close-up
Anatomy of the Knee
Immediate Post-Op X-ray
Progressive Healing X-ray
Outcome

• Trial was scheduled for 2013 – far enough into the future to allow for the final, medical results to become apparent.

• The leg healed but became a useless, dangling appendage.

• The patient underwent an amputation so that a functional prosthesis could be fitted.

• The case settled for plaintiff without going to trial.
Forensic Issues

• EMS: None

• Emergency Department:

  1- What was discussed in the phone consultation between the PA and the on-call orthopedist?

  2- In light of the triage note describing the lower leg temperature as “cool” and the foot as “numb” and realizing the potential for vascular injury with this kind of fracture, should a vascular flow study have been done?

  3- Should the discharge instructions have been specific for signs & symptoms of compartment syndrome?
Forensic Issues (cont’d)

• Pediatrician’s Office:

1- Did the pediatrician examine the leg or not?

2- Even without an exam, shouldn’t the pediatrician have been concerned enough about this injury to have arranged for immediate orthopedic consultation?

3- One of plaintiff’s experts, a professor of pediatrics from UCSF, opined at deposition that the pediatrician fell below the standard of care by not getting immediate orthopedic consultation on the day that the patient was seen in the office for follow-up.
Forensic Issues (cont’d)

• **Orthopedist on-call:**

  1- When consulted by phone by the PA, did he ask key questions about the physical examination of the leg and the appearance of the fracture on the x-rays?

  2- Shouldn’t he have been thinking of the possibility of a vascular injury and the need for an arterial flow study?

• **Orthopedist’s office (in follow-up):** None

• **Surgeons (ortho & vascular):** None
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The End

Questions?

References to follow . . .


References (cont’d)


Thank you for attending!

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