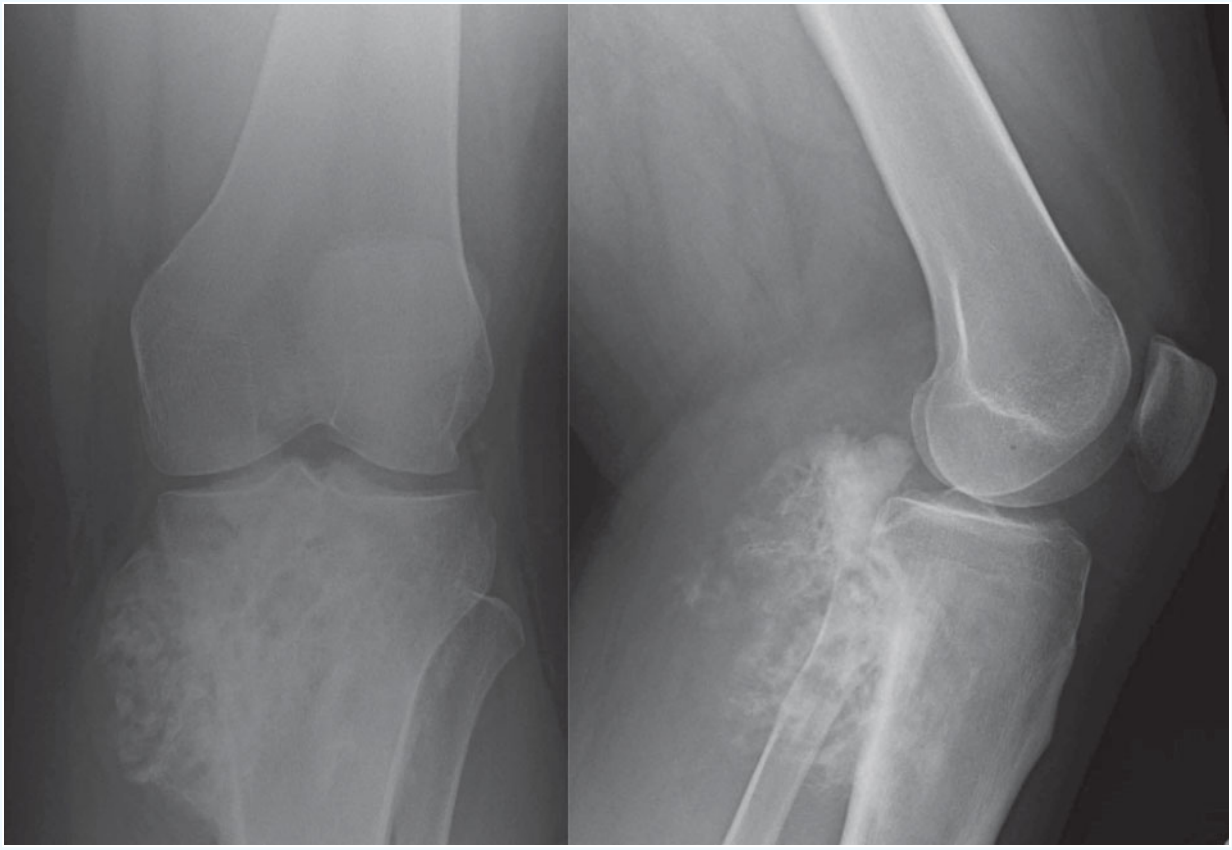


CLINICAL IMAGE CHALLENGE
X-RAY

Editor's Note: While the images presented here are authentic, the patient cases are hypothetical.

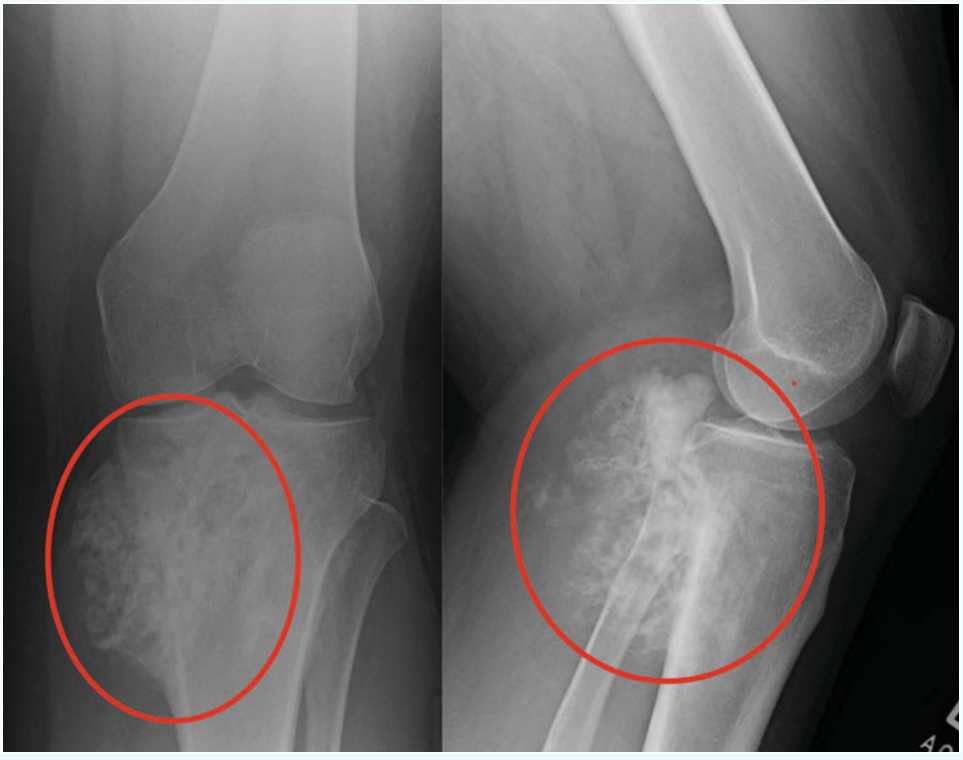
22-Year-Old With Growing, Painful Lump on Back of Knee



A 22-year-old male presents to urgent care complaining of a painful lump on the back of his left knee that developed roughly 3 years prior. It has gradually grown in size and discomfort since then. The lump has been growing more quickly and becoming more painful over the last month, to the point where it is difficult to play sports and exercise. Physical examination reveals normal vital signs and full range of motion and strength of the knee. A large, hard, bony, and immobile mass is visible and palpable in the popliteal fossa. It is diffusely tender to palpation. There is no erythema, induration, fluctuance, or warmth noted to the mass. There are no neurovascular deficits distal to the knee.

View the x-ray images taken and consider what your diagnosis and next steps would be. Resolution of the case is described on the following page.

Acknowledgment: Images and case provided by Experity Teleradiology (www.experityhealth.com/teleradiology).



Differential Diagnosis

- Secondary chondrosarcoma
- Myositis ossificans
- Osteochondroma
- Parosteal osteosarcoma
- Baker cyst

Diagnosis

The leading diagnosis is osteochondroma. This radiograph shows a large, lobulated, sessile surface lesion arising from the proximal tibia with extensive mineralized matrix, which is consistent with a cartilage-containing surface bone tumor. There is cortical and medullary continuity between the lesion and the parent bone seen on the anteroposterior (AP) view, which is a hallmark of osteochondroma. The lateral view demonstrates significant posterior extension, raising concern for possible complications, including bursa formation, fracture of the stalk, or malignant transformation.

Osteochondroma is the most common benign bone tumor, making up 20–50% of all benign bone tumors. Approximately 1% of solitary osteochondromas progress through malignant transformation to secondary peripheral chondrosarcoma. In this particular case, the large size of the mass, the history of chronic pain with acute exacerbation, and the context of the patient's age and skeletal maturity mandate further evaluation.

What to Look for

- Red flags for potential malignancy include new-onset or worsening pain after skeletal maturity, continued growth after growth plate closure, and a cartilage cap thickness of >1.5–2 cm on magnetic resonance imaging (MRI) or computed tomography (CT), if advanced imaging is available.
- Acute exacerbation of pain may represent a fracture through the osteochondroma stalk (particularly in athletes), bursa formation over the lesion, or neurovascular compression–all recognized complications that can cause sudden worsening of symptoms without malignant transformation.

Pearls for Urgent Care Management

- Concern for malignancy indicates a need for advanced imaging. MRI with contrast is indicated for further characterization.
- An urgent referral to orthopedics is warranted for further workup given the presentation.
- Counsel the patient that a biopsy will likely be performed by the orthopedic specialist. ■

43-Year-Old Male With Large Bump on Elbow



A 43-year-old man presents to urgent care reporting a soft lump that developed on his arm 3 months prior. He denies pain, itching, or systemic symptoms and feels well otherwise. Examination reveals normal vital signs and a 5 cm soft, mobile, nontender subcutaneous nodule on the proximal dorsal forearm. Range of motion for the elbow and wrist is normal. No erythema or induration is noted; circulation, strength, and sensation are intact distally.

View the image taken and consider what your diagnosis and next steps would be. Resolution of the case is described on the following page.

Acknowledgment: Image and case presented by VisualDx (www.VisualDx.com/jucm).



Differential Diagnosis

- Epidermoid inclusion cyst
- Lipoma
- Neurofibroma
- Sarcoma
- Pilar cyst
- Pilomatricoma

Diagnosis

The correct diagnosis is lipoma. Superficial subcutaneous lipomas are the most common benign soft-tissue neoplasms. They consist of collections of mature fat cells enclosed within thin fibrous capsules. Lipomas can occur on any part of the body and usually develop superficially within subcutaneous tissue. Rarely, they may involve fascia or deeper muscular planes. Malignant transformation of a lipoma into a liposarcoma is rare.

The diagnosis of lipoma is typically made clinically.

What to Look for

- Lipomas present as soft, painless subcutaneous nodules ranging in size from 1 to >10 cm.
- They occur most frequently on the trunk and upper extremities and can be round, oval, or multilobulated. Frequently, patients may have more than one lipoma.
- Ultrasound examination can be helpful to distinguish a lipoma from an epidermoid or ganglion cyst.

Pearls for Urgent Care Management

- Consider referral to surgery or dermatology for removal if the lipoma is bothersome to the patient.
- Definitive treatment of lipomas (if needed because of pain, cosmesis, or concerns over diagnosis) is surgical removal of the entire capsule. Recurrence of an excised lipoma is not common.
- If a suspected lipoma is firm rather than soft, is rapidly enlarging, or causes pain or restriction of movement, a biopsy is indicated to confirm the diagnosis and exclude malignancy. ■



CLINICAL IMAGE CHALLENGE
ECG

29-Year-Old With Muscle Weakness

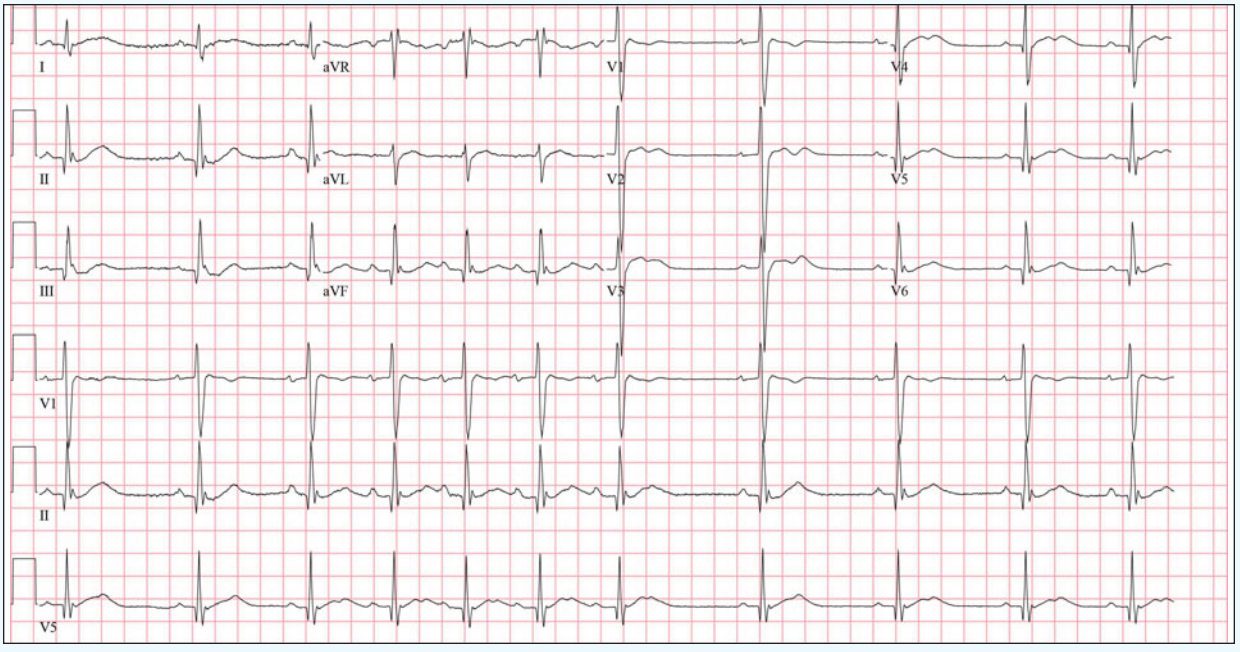


Figure 1: Initial ECG

A 29-year-old male presents to urgent care with generalized muscle weakness. His oxygenation is normal on room air, and his blood pressure is 117/72 mm Hg. He denies chest pain, palpitations, or shortness of breath. An ECG is obtained.

View the ECG and consider what your diagnosis and next steps would be. Resolution of the case is described on the next page.

Case presented by Catherine Reynolds, MD, McGovern Medical School at UTHealth Houston.
Case courtesy of ECG Stampede (www.ecgstampede.com).

ECG STAMPEDE



Figure 2: Prominent U waves fuse with T waves to form a wavy repolarization complex in lead V2 (red). The repolarization complex creates a long QT (or QU) interval of 520 milliseconds (dashed line).

Differential Diagnosis

- Hypokalemia
- Hypocalcemia
- Brugada syndrome
- Left ventricular hypertrophy with strain
- Normal sinus rhythm

Diagnosis

The diagnosis in this case is hypokalemia. The ECG reveals a sinus rhythm with marked sinus arrhythmia and a ventricular rate of 64 beats per minute. There is marked prolongation of the QT interval due to the presence of prominent U waves that have fused with the T waves, creating a wide, wavy repolarization pattern across the precordial leads.

Discussion

Hypokalemia is a common and potentially life-threatening electrolyte abnormality that delays ventricular repolarization.[1] The characteristic ECG changes in hypokalemia include T wave flattening or inversion, ST-segment depression, and the development of prominent U waves. In severe cases such as this one, these U waves merge with the preceding T waves, creating a biphasic TU fusion complex that prolongs the QT (or QU) interval.[2] This is illustrated in **Figure 2**.

This QU pattern in hypokalemia is caused by a delay in the repolarization phase (phase 3) of the cardiac action potential. This patient's clinical presentation of generalized weakness combined with a QTc of >500 milliseconds and prominent precordial U waves is highly diagnostic of severe hypokalemia. Hypokalemia commonly occurs due to gastrointestinal losses (such as vomiting or diarrhea), renal losses (associated with diuretic use or hyperaldosteronism), alcohol abuse, or poor nutritional intake. It is estimated that approximately 3% of hospitalized patients have hypokalemia, and severe hypokalemia (potassium <2.5 milliequivalents per liter) is associated with a high incidence of cardiac arrhythmias.[3]

A long QT or QU interval increases the risk of a new electrical impulse firing before the heart has finished repolarizing – referred to as an early afterdepolarization. If premature depolarization occurs, it can trigger a life-threatening arrhythmia called torsades de pointes. Bradycardia exacerbates this risk by lengthening the repolarization phase, making overdrive pacing—either pharmacologic or electrical—a key strategy for preventing torsades de pointes in patients with acquired long QT states.

Urgent care management of suspected severe hypokalemia focuses on screening for complications, initiating replacement therapy, and immediate transfer. A thorough history should screen for symptoms of hypoperfusion, palpitations, or syncope. Initial steps include establishing intravenous access, placing the patient on continuous cardiac monitoring, and checking a basic metabolic panel to determine the potassium level. Since hypokalemia is frequently accompanied by hypomagnesemia, a magnesium level should also be checked and replaced as necessary. Patients with a severely prolonged QT or QU interval (>500 milliseconds) or who are symptomatic require immediate transfer via emergency medical services to a facility with telemetry monitoring for repletion and continuous cardiac monitoring.

Hypocalcemia prolongs the QT interval by extending the plateau phase (phase 2) of the cardiac action potential (lengthening the ST segment but with a normal T wave). In terms of the differential diagnoses, Brugada syndrome is

characterized by a pseudo-right bundle branch block and downsloping ST-segment elevation in leads V1 and V2, which are absent here. Left ventricular hypertrophy with strain shows high QRS voltages and asymmetric T wave inversions in the lateral leads, and a normal sinus rhythm would not feature these severe repolarization abnormalities.

What to Look for

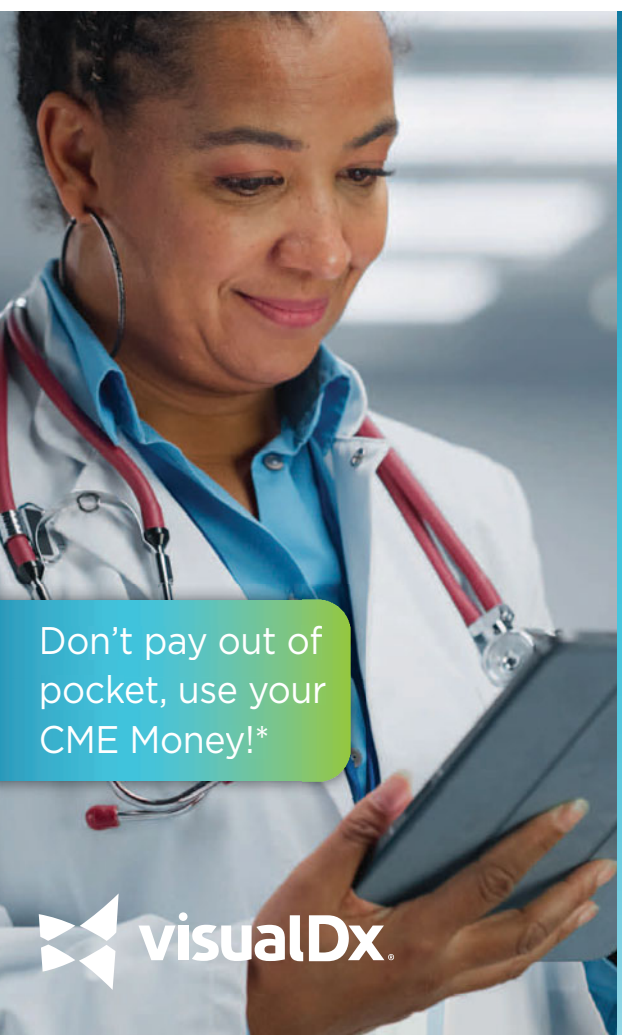
- Look for a wide, wavy repolarization pattern across the precordial leads, indicating the fusion of T waves and prominent U waves of severe hypokalemia.
- Bradycardia in the setting of a prolonged QT or QU interval (>500 milliseconds) increases the risk of triggering torsades de pointes.
- Hypokalemia and hypomagnesemia commonly coexist, and both require aggressive replacement to stabilize ventricular repolarization.

Pearls for Initial Management, Considerations for Transfer

- Establish intravenous access and initiate continuous cardiac monitoring.
- Obtain emergency laboratory testing, including a basic metabolic panel and magnesium level if available.
- Replenish both potassium and magnesium, using oral and parenteral routes depending on patient tolerance and severity.
- Transfer the patient immediately via telemetry-monitored transport to the nearest emergency department if the QT or QU interval is >500 milliseconds or if the patient is symptomatic. ■

References

1. Cooper B, Reynolds C. *ECG Stampede: The Textbook.* 3rd ed. Houston, TX: ECG Stampede Publishing; 2024.
2. Cooper B, Reynolds C. *ECG Stampede: The Workbook.* 2nd ed. Houston, TX: ECG Stampede Publishing; 2024.
3. Surawicz B, Childers R, Deal BJ, et al. AHA/ACCF/HRS Recommendations for the standardization and interpretation of the electrocardiogram: part III: intraventricular conduction disturbances. *J Am Coll Cardiol.* 2009;53(11):976-981. doi:10.1016/j.jacc.2008.12.013



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