Abstract:

A previously healthy 20-year-old man presented to the emergency department with difficulty walking and bilateral heel pain. His pain started acutely in the right heel approximately 3 months prior to presentation with no known trauma or injury. He had previously been treated with steroids for presumed tendinitis and magnetic resonance imaging of his ankle showed a possible partial tear of the right Achilles tendon. His pain worsened and involved swelling of both heels so that he was unable to walk. On presentation, he had a normal neurological exam. His musculoskeletal exam was pertinent for pain over the calcaneus bilaterally and swelling with firmness over both Achilles tendons. Labs were notable for an elevated uric acid, and a computed tomographic scan of his feet showed the presence of monosodium urate crystal deposition, consistent with a diagnosis of gouty arthritis. Despite gout being a disease diagnosed almost exclusively in adults, pediatric providers must consider this and other diseases that typically affect adults, especially when treating patients at the older end of the pediatric spectrum.

Keywords:

gout; heel pain; difficulty walking; pediatrics

Presented at the Section on Emergency Medicine Emergi-Quiz Case Competition at the American Academy of Pediatrics National Convention and Exhibition, Orlando, FL, November, 2018.

*Department of Emergency Medicine,

Please Heel Me, I Can't Walk!

Wendi-Jo Wendt, MD*, Allison Cator, PhD, MD†, Andrew Hashikawa, MD†

A previously healthy 20-year-old Middle Eastern male presented with his parents to our pediatric emergency department (ED) with complaints of bilateral heel pain causing inability to walk. Approximately 3 months prior to presentation, he had acute onset of right heel pain and right foot pain, without preceding injury. Pain was mostly in the right heel and worsened with deep pressure or walking. He was evaluated by his primary care provider who prescribed ibuprofen and gave him a "steroid shot". A couple of weeks later, he went to an outside ED because of continued heel pain. There he was prescribed a steroid burst for presumed Achilles tendinitis and had temporary improvement of symptoms. The following month, heel pain returned, and he was evaluated by a podiatrist who thought his symptoms were consistent with an Achilles tendon tear after magnetic resonance imaging (MRI) revealed a possible partial tear. He underwent another round of oral steroids, which again only temporarily stopped the pain. Over the next month right heel pain returned, and he began using crutches and then a roller scooter to get around. Over the past 1 week prior to presentation in our ED, he began having acute onset of severe pain and swelling in his opposite (left) heel and small toes (3rd, 4th and 5th) without any skin changes of the foot. Both heels were swollen, with the left now worse than the right, and he was unable to walk due to pain, requiring him to crawl to get around until he obtained a wheelchair. Epsom salt soaks helped minimally and there were no other alleviating or exacerbating factors. There was no injury that he could recall. He did not play sports and in fact was quite sedentary. He had no history of similar symptoms in the past.

On review of systems, the patient denied fever, chills or weight loss. No oral or nasal ulcers. No vision changes, eye pain or other ocular symptoms. No chest pain or shortness of breath. He endorsed diarrhea for about a month and intermittent constipation, but no abdominal pain, nausea, vomiting or blood

Division of Pediatric Emergency Medicine, Michigan Medicine, Ann Arbor, MI; †Department of Emergency Medicine, Department of Pediatrics, Michigan Medicine, Ann Arbor, MI.

Reprint requests and correspondence: Wendi-Jo Wendt, MD, Children's Emergency Services, Department of Emergency Medicine, University of Michigan Medical School, 1540 East Hospital Drive, CW 2–737, SPC 4260, Ann Arbor, MI 48109–4260.

1522-8401

in stools. There were no urinary symptoms. No other joint pain or swelling. No rash or other skin changes. No recent antibiotic exposures. He endorsed an 80-lb weight gain over the past year.

The patient had no past medical history. Surgical history was pertinent for a previous left thumb tendon repair and right index finger tip repair. He was taking no daily prescription or over-the-counter medications or supplements. Family history was positive for anemia in his mother, diabetes in one grandparent and hypertension in another grandparent. He reported that he lived at home with his parents and siblings. He was sexually active with one female partner. He denied smoking, alcohol or drug use. There was no recent travel.

Initial vital signs were within normal limits for age. On exam, he appeared well-developed and well-nourished, overweight, and in no acute distress. He had a normal neurologic exam but was unable to ambulate secondary to pain. His musculoskeletal exam was pertinent for no gross deformities. His right foot had firmness of the Achilles tendon with mild swelling and mild tenderness. His right third, fourth, and fifth toes had tenderness at the metatarsophalangeal joint and proximal interphalangeal joints, decreased flexion secondary to pain and mild tenderness of the calcaneus. His left foot had firmness of the Achilles tendon with tenderness and swelling. In addition, there was tenderness of the distal third, fourth, and fifth toes and metatarsals. He had exquisite tenderness over the left calcaneus. Thompson test was performed and demonstrated spontaneous plantar flexion of the ankle bilaterally when the calf was squeezed (negative or normal).

Initial laboratory testing included a complete blood count (CBC) with differential, electrolytes, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP). The CBC, differential and electrolytes were within normal limits, as were the ESR (20 mm/h) and CRP (0.5 mg/L). (Table 1) Bilateral foot x-rays were negative for fracture, dislocation or effusions, but notable for osteopenia of the right foot. There was also a triangular shaped lucency within the posterior left calcaneus with a well-formed sclerotic border and overlying soft tissue swelling (Figure 1). A lower extremity duplex ultrasound (DVU) was negative for a deep vein thrombosis (DVT). Finally, an ultrasound (US) of bilateral ankles was obtained to evaluate the Achilles tendons and showed no obvious tendon tear.

DIFFERENTIAL DIAGNOSIS

Limping is a common chief complaint in the pediatric ED and the differential diagnosis is broad, age-dependent and includes multiple systems, making diagnosis challenging. A thorough history and physical

TABLE 1. Selected laboratory results.

CBC		CHEM	
WBC	10.2	Na	138
HGB	15.1	K	4
HCT	42.3	Cl	101
PLT	333	CO2	25
RBC	5.12	BUN	13
MCV	82.6	Cr	0.69
MCH	29.5	Glu	115
MCHC	35.7	Ca	11.3
RDW	11.5		
MPV	9.7	ESR	20
Neutrophil %	58.5	CRP	0.5
Lymphocyte %	30.9		
Monocyte %	9.2		
Eosinophil %	0.4		
Basophil %	0.3		

exam are necessary to guide possible work-up with laboratory studies and imaging. A systematic approach should be employed to evaluate for the three most important causes of limping in a pediatric patient: traumatic injury, infection and neoplasia, given the possible complications from delayed diagnosis.[1] Additionally, the differential diagnosis significantly changes based on the age of the patient. In adolescents and young adults, the differential includes neurologic, musculoskeletal, oncologic, rheumatologic, infectious and psychogenic causes.

The more common causes of limping in an adolescent patient include slipped capital femoral epiphysis (SCFE), juvenile idiopathic arthritis, overuse syndromes, osteochondrosis, tumors, osteochondritis dissecans, stress fractures, tarsal coalition and discoid meniscus.[1,2] In addition to these more common problems, adolescents may also present with limping in association with osteomyelitis, inflammatory bowel disease-related enthesitis, spondyloarthropathies, sarcoidosis, leukemia, psoriatic arthritis, calcaneal apophysitis (Sever's disease), tendo-achilles bursitis, Achilles tendonitis, tarsal tunnel syndrome, plantar fasciitis and rheumatoid arthritis.

Figure 1. XR left foot with triangular shaped lucency in the calcaneus with a well-formed sclerotic border and overlying soft tissue swelling.

Given our patient's age, the differential diagnosis needed to be expanded to include problems that are traditionally thought of in adult patients. These diagnoses include plantar fasciitis, tarsal tunnel syndrome, gout, posterior tibialis tenosynovitis, retrocalcaneal bursitis, and osteoarthritis.[3] In our patient, the differential diagnosis was broad, including, osteomyelitis, calcaneal apophysitis, tendo-achilles bursitis, Achilles tendonitis, tarsal tunnel syndrome, plantar fasciitis, rheumatoid arthritis, gout, posterior tibialis tenosynovitis, retrocalcaneal bursitis, osteoarthritis and enthesitis. Given our patient's sedentary lifestyle, overuse injuries were less likely. The chronicity of the injury also made psychogenic and rheumatologic causes more likely than infectious causes.

CASE PROGRESSION AND DIAGNOSIS

To evaluate for malignancy and endocrine disorders, additional laboratory studies were obtained, including uric acid, lactic acid dehydrogenase (LDH) and thyroid stimulating hormone (TSH). Uric acid was elevated at 12.2 mg/100 mL (reference range, 3.5-7.8) while LDH was normal at 224 U/L. Given elevated uric acid, recent weight gain, and heel and toe pain there was concern on the part of the ED clinicians for gout.

Orthopedics was consulted and did not feel symptoms were consistent with osteomyelitis (normal CRP, low ESR, and no fever). Based on patient's bilateral foot pain, history, physical exam, and lab work up they felt that his presentation was consistent with a picture of gouty arthritis. Ultrasound was recommended looking specifically for gout; this showed a subcutaneous thickening of the left dorsal forefoot with reticulated edema and no evidence of tenosynovitis. There were irregular hypoechoic irregularities along the distal aspects of bilateral Achilles tendons (Figure 2). Given significant concern for gout, Pediatric Rheumatology was consulted and recommended a computed tomography (CT) study of bilateral feet to assess for tophi which was consistent with tophaceous gout (Figure 3).

The patient was initiated on indomethacin 50 mg 3 times daily for presumed gout and was admitted to the inpatient hospitalist team for continued

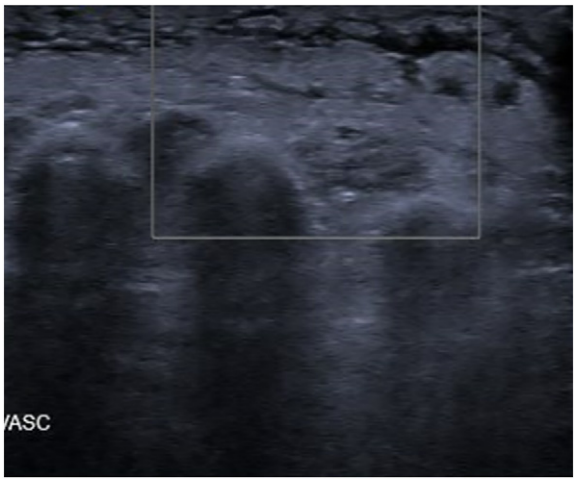

Figure 2. Ultrasound of left foot showing subcutaneous thickening with edema.

monitoring for improvement. In addition to the CT scan, rheumatology recommended fecal calprotectin to assess for inflammatory bowel disease (with outpatient GI referral) and to send the patient home with indomethacin 50 mg 3 times daily until outpatient clinic follow-up. Physical therapy, low-purine and -uric acid diet, and weight loss were also recommended. He was started on cholecalciferol 2000 units daily and continued taking indomethacin.

After hospital discharge, the patient was evaluated in endocrinology clinic given hypercalcemia and hyperuricemia. Parathyroid hormone (PTH) was found to be elevated to 160 pg/mL (reference range 10-65 pg/mL). Physician-performed thyroid, parathyroid, and cervical lymph node ultrasound was normal with no abnormalities seen in typical areas of parathyroid adenoma. He was ultimately diagnosed with hyperparathyroidism. Medical genetics evaluation was negative for familial hypocalciuric hypercalcemia (FHH) and hereditary cancer predisposition syndromes. Outpatient GI evaluation was negative for inflammatory bowel disease and he was diagnosed instead with irritable bowel syndrome. In the weeks following hospital discharge, he reported resolution of left heel pain, and improvement of right heel symptoms although still with an occasional right-sided limp. Physical therapy also was helpful to help him regain strength. Surgery was scheduled to treat his primary hyperparathyroidism.

DISCUSSION OF THE DIAGNOSIS

Limping is a common pediatric complaint in the pediatric ED. The differential diagnosis is vast, encompasses many different systems and it can be difficult to make a definitive diagnosis. Many cases of adolescent joint pain or limping are attributed to overuse injuries but when the pain persists, and the history does not support a musculoskeletal injury, the differential must be widened to include less common diagnoses. Ultimately, the patient was diagnosed with primary hyperparathyroidism with secondary gout. Gout is uncommon in the pediatric population; however, as pediatricians are increasingly tasked with caring for patients on the older end of the age spectrum, more thought will need to be given towards

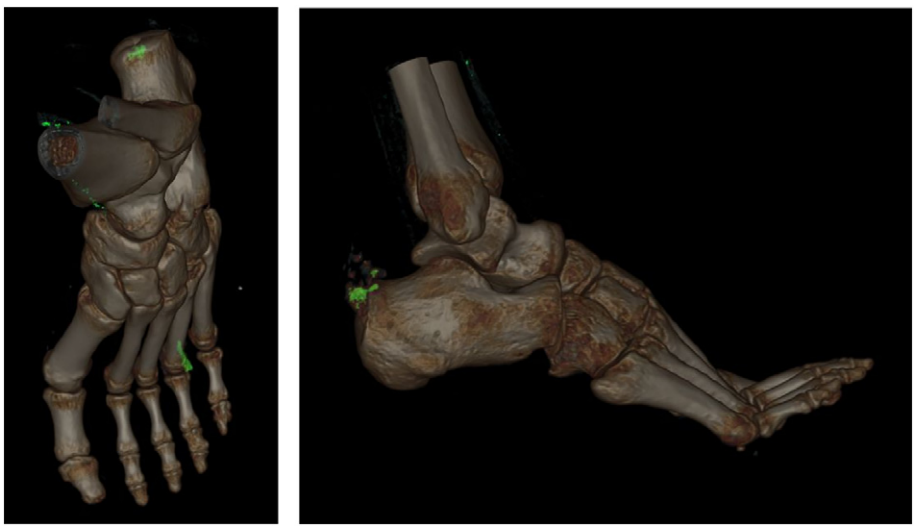

Figure 3. 3D CT reconstruction of both ankles and feet: Green represents gout crystal deposition.

diagnoses that were previously not considered pediatric diseases.[4]

Gout is a type of arthritis that results from deposition of monosodium urate crystals in the tissues and is typically seen in the adult population. For deposition of urate crystals, serum uric acid levels must be elevated but not all people with elevated uric acid levels have urate crystal formation or deposition; therefore, additional genetic factors must play a role.[5] The gold standard for diagnosis of gout depends on the identification of monosodium urate crystals in the synovial fluid. In practice, a combination of laboratory testing and imaging are often used in diagnosis. Risk factors for the development of gout include male sex, increasing age and obesity. Elevated uric acid levels can be caused by overproduction or underexcretion of uric acid.[5] Despite gout primarily being an adult male diagnosis, the proportion of males to females has decreased to 2:1 recently and gout is being reported in the juvenile population more frequently, mostly linked to obesity.[6] Additionally, there are other risk factors and associations including, as in our patient, hyperparathyroidism.

Parathyroid hormone (PTH) is the primary regulator of calcium concentrations in the body, is produced by the parathyroid glands, and is a regulator of bone turnover. Hyperparathyroidism can be primary (high calcium concentration and high PTH), secondary (low calcium concentration and high PTH) or tertiary (seen in end-stage renal disease).[7] Our patient had primary hyperparathyroidism with an elevated PTH and elevated serum calcium concentration. There is a known association between elevated PTH levels and increased uric acid levels,[8,9] a risk factor for the development of gout; however, the mechanism between elevated PTH levels and elevated uric acid levels remains unclear.[9] Primary hyperparathyroidism, as in our patient, can be caused by hyperplasia of the parathyroid, adenoma, or more rarely, carcinoma. Multiple endocrine neoplasia type 1 (MEN1) and multiple endocrine neoplasia type 2A (MEN2A) are associated with hyperparathyroidism. MEN1 is characterized by pituitary tumors, insulinomas, or gastrinomas and generally presents in the second or third decade of life but can occasionally present in the first decade of life. MEN2A is characterized by medullary thyroid carcinoma, pheochromocytoma, and parathyroid adenoma. Parathyroid disease is less common in MEN2A than in MEN1 but has been described in children.[7]

SUMMARY

The differential for limping or heel pain in the adolescent patient is vast and the diagnosis can be challenging; therefore, a thorough history and physical exam with a systematic approach to the evaluation and work-up are necessary. Our patient was a 20-year-old male, outside the historical age-range of pediatric patients, with a typically "adult" diagnosis, which likely contributed to his delayed diagnosis of gout secondary to primary hyperparathyroidism. The American Academy of Pediatrics (AAP) recently began discouraging setting arbitrary age limits (age 21) for pediatric health care, thereby increasing the number of young adults that are potentially cared for by pediatricians. Furthermore, medically complex young adults with 'pediatric diseases' are frequently followed by pediatric specialists well beyond age 21 and are likely to seek care in the pediatric ED. Pediatric emergency medicine physicians must increasingly consider including "adult" problems in their differential diagnoses when caring for these older patients.[4]

DISCLOSURES

No relevant financial or non-financial relationships to disclose.

REFERENCES

1. Herman MJ, Martinek M. The limping child. Pediatr Rev 2015; 36(5):184-95, quiz 196-197.
2. Santili C, Junior WL, de Oliveira Goiano E, et al. Limping in children. Rev Bras Ortop 2009;44(4):290-8.
3. Cardell DL, O'Rorke JE. Chapter 57. Foot and ankle pain, in Henderson MC, LM Tierney LM, Smetana GW eds. The patient history: an evidence-based approach to differential diagnosis, 2nd edition. New York, NY: The McGraw-Hill Companies; 2012.
4. Hardin AP, Hackell JM. American Academy of Pediatrics Committee on Practice and Ambulatory Medicine. Age limit of pediatrics Pediatrics 2017;140(3)e20172151.
5. Ragab GM, Elshahaly XX, Bardin T. Gout: an old disease in new perspective—a review. J Adv Res 2017;8:495-511.
6. Morris H, Grant K, Khanna G, White AJ. Gout in a 15-year-old boy with juvenile idiopathic arthritis: a case study. Pediatr Rheumatol Online J 2014;12:1.
7. Markowitz ME, Underland L, Gensure R. Parathyroid disorders. Pediatr Rev 2016;37:524-35.
8. Mintz DH, Canary JJ, Carreon G, Kyle LH. Hyperuricemia in hyperparathyroidism. N Engl J Med 1961;265:112-5.
9. Chin KY, Nirwana SI, Ngah WZ. Significant association between parathyroid hormone and uric acid level in men. Clin Interv Aging 2015;10:1377-80.