Case report

An infective cause for the limping child

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Accepted 13 August 2019

SUMMARY

A 7-year-old girl presented with left hip pain and a limp, in the absence of any other systemic features, having recently been treated for a urinary tract infection. Examination revealed limited active hip movements on the left, with a tendency to weight bear on the contralateral side. Biochemical investigations were significant for raised inflammatory markers, and subsequent MRI imaging revealed osteomyelitis of the left pubis and ischium with an associated large soft tissue collection. Treatment was bimodal with surgical drainage and long-term antibiotics. The patient consequently recovered, without significant effect on either growth or mobility.

BACKGROUND

Hip pain, particularly in the paediatric and adolescent group, is a common presentation in primary and emergency care settings. It poses a significant diagnostic challenge as the range of causative underlying conditions vary from relatively benign to potentially life threatening, and the presentation may be of transient synovitis of the hip to septic arthritis and to osteomyelitis. Prompt identification, diagnosis and treatment of the underlying cause can reduce complications, including growth arrest and chondrolysis, in susceptible patients.

This case report highlights a case of osteomyelitis of the pelvis presenting as hip pain in an otherwise clinically well child. It highlights many diagnostic challenges physicians face when presented with a patient with hip pain, and the pitfalls of standard clinical and radiographical assessment in formulating a diagnosis.

CASE PRESENTATION

A 7-year-old girl, otherwise fit and well, presented to the clinic with an acute 12-day history of left groin pain and an inability to weight bear on that side, triggered when she accidentally ran into a coffee table. She was systemically well with no reported fevers. Of note, she had seen her general practitioner 10 days prior, who treated her for a urinary tract infection (with trimethoprim), following a positive urine dipstick result. She also had radiographs of the hip and femur, respectively, performed in the emergency care setting in the previous week. The radiographs were reported as no fracture evident, and so the patient was discharged. On examination in clinic, the patient had discomfort moving the hip actively. Passively, she had normal abduction and external rotation, with reduced adduction and internal rotation.

Faber's test was negative. She had a fixed flexion deformity of the left hip to 40° but could further flex to 90° passively and demonstrated an antalgic gait, with weight bearing on the right on standing. Examinations of the joint above and below were unremarkable and she had no neurological deficit.

INVESTIGATIONS

Biochemical and haematological investigations were significant for raised inflammatory markers: white cell count (WCC) of $19.8 \times 10^9/L$, ($5.0\text{--}13.0 \times 10^9/L$), neutrophil count of $14.1 \times 10^9/L$ ($2.0\text{--}8.0 \times 10^9/L$), C-reactive protein (CRP) of 38 mg/L ($0\text{--}5\text{ mg/L}$) and erythrocyte sedimentation rate (ESR) of 55 mm/1 hour ($1\text{--}20\text{ mm/1 hour}$). Blood cultures did not isolate any specific pathogen.

The most recent pelvic radiograph taken 2 days prior to admission demonstrated a prominent apophysis at the left inferior pubic ramus which was considered a normal variant (figure 1). An MRI performed on admission demonstrated osteomyelitis of the left pubis and ischium with a large bi-loculated collection, measuring $5 \times 3 \times 3\text{ cm}$ and $3.2 \times 2.5 \times 2.2\text{ cm}$, respectively, involving the anterior abdominal wall and left adductor compartment (figure 2).

DIFFERENTIAL DIAGNOSIS

Broadly, the causes of hip pain can be subdivided into developmental (eg, Perthes disease, slipped capital femoral epiphyses), infectious or inflammatory (eg, transient synovitis, septic arthritis, osteomyelitis), overuse injuries (eg, muscle strains and tendinopathies, apophysis and avulsion injuries, stress fractures) or neoplastic causes. Non-musculoskeletal causes, such as pain referred from the lower back, abdomen or pelvis, must also be considered in the spectrum of pathologies.

TREATMENT

Treatment initially consisted of empirical intravenous antibiotic therapy with flucloxacillin and gentamicin, followed by surgical drainage of the large soft tissue collection. This was performed via two separate incisions—Pfannenstiel incision for the lower abdomen and Ludloff's approach for the adductor region of the hip.

Fluid and tissue samples were collected intraoperatively and subsequently cultured for *Staphylococcus aureus*, and the antibiotics were switched accordingly to flucloxacillin and rifampicin depending on the microbiological reports.

The patient received dual antibiotic therapy for a period of 6 weeks; the first 2 weeks given intravenously through a midline catheter, followed by 4 weeks orally.

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To cite: Jumabhoy I, Uzoho C, Desai V. *BMJ Case Rep* 2019;**12**:e228964. doi:10.1136/bcr-2018-228964

Figure 1 Pelvic radiograph demonstrating periosteal changes of the left inferior pubic ramus.

OUTCOME AND FOLLOW-UP

Review of the patient at 4 weeks postoperatively demonstrated a normal range of passive hip movements, including flexion, extension, abduction, adduction and internal and external rotation, though some residual antalgic gait remained.

At 3 months, the patient was at baseline clinically and biochemically, with no obvious effect on her growth or mobility.

DISCUSSION

Paediatric hip pain, presenting as an antalgic gait, is a common presentation in both primary and secondary care settings. As reported above, there is a wide range of causes (see [table 1](#)), of which the most common is infective or inflammatory (eg, transient synovitis). A combination of a high index of suspicion and a systematic approach to diagnosis and management is often required to delineate septic arthritis from osteomyelitis.

The incidence of osteomyelitis, at 2–13 per 100 000 children, is approximately twice that of septic arthritis, with a similar distribution noted in both men and women.¹ There is geographical variance in incidence, though the average age at diagnosis

remains approximately 6.6 years.² The degree of overlap in presentation with other common orthopaedic and infective processes, and the variety of presenting signs and symptoms, often leads to a delay in diagnosis—on average of 12 days.³

Clinically, both conditions may present with hip or thigh pain and swelling, limited range of motion, limp and difficulty or refusal to weight bear. Non-specific symptoms, such as fevers, anorexia and weight loss, are relatively more common in the paediatric population.⁴ Although there is no single diagnostic test to differentiate septic arthritis and osteomyelitis, the range of movement in the hip is often preserved until late with osteomyelitis as the joint itself may be unaffected. For instance, in this case, the patient was assessed twice in the emergency care setting and erroneously reassured that there was no underlying infectious disease process partly on the basis of preserved joint movement on examination. In fact, while septic arthritis may have been considered unlikely, the underlying diagnosis of osteomyelitis should have been considered.

Similarly, clinical biochemistry may be a useful adjunct in diagnosis, with WCC, ESR and CRP often requested. In children with osteomyelitis, an elevated WCC is encountered in 36% of patients, with an elevated ESR in 91% of patients.² Due to the different rates of change and normalisation of these values, a combination of both ESR and CRP is often recommended. These non-specific inflammatory markers are raised in a host of infectious and inflammatory processes, and while Kocher's criteria can be reliably applied to distinguish between transient synovitis and septic arthritis, there remain no equivalent diagnostic criteria for osteomyelitis.⁵

The most important step in diagnosis is isolation of the causative organism, commonly *S. aureus*.⁶ Blood cultures may be negative in approximately 50% of the cases, and so bone biopsy of the affected area is imperative.^{3,7} Additionally, the pathogen isolated is dependent on the patient's age, comorbidities, socioeconomic and immune status and vaccination history.⁸ For instance, gram-negative bacteria account for a larger proportion in children under the age of 4, while *Streptococcus pneumoniae* was identified in 67% of HIV-positive children.⁹

Plain radiographs, often the first line imaging study, are frequently normal in both septic arthritis and osteomyelitis, with signs often taking 10–14 days to manifest in the latter.¹⁰ Initial changes include soft tissue changes and blurring of the soft tissue planes, with compromise of 30%–50% of bone mineral content required to produce noticeable bony changes (eg, periosteal thickening, endosteal scalloping and lytic lesions).¹¹ It is plausible that the radiographical changes identified in this case actually represented an early periosteal reaction rather than a normal variant of an apophysis. For this reason, early MRI is helpful to better describe the location and disease extent, as well as to plan surgical intervention.¹² It has a reported sensitivity of between 82% and 100% and specificity between 75% and 96%.¹³ Ultrasound, which may have a role in assessing and aspirating joint fluid in septic arthritis, and PET/CT have also been used infrequently.

Once a firm diagnosis is made, treatment can be conducted. This is usually bimodal and consists of a reduction in bacterial load via surgical intervention, followed by prolonged antibiotics. While septic arthritis necessitates a joint washout, either arthroscopically or open, surgical drainage for osteomyelitis is reserved for abscess formation, failure of antibiotic therapy or extensive disease.¹⁴ The choice, duration and route of antibiotic therapy remain a topic of significant debate, but recent landmark randomised trials have provided more high-quality evidence to guide treatment. For instance, the recently published

Figure 2 MRI sequence demonstrating bone marrow oedema in the left pubis and ischium with an associated bi-loculated collection.

Table 1 Differential diagnosis for the paediatric patient presenting with hip pain

	Mechanical	Inflammatory	Infectious	Neoplastic
Age	>10 years old	Common all ages	<4 years old	Uncommon all ages
Risk factors	Trauma, including repetitive strain related to activities	Recent infection (viral/bacterial), trauma	Previous invasive procedures, history of immune compromise (eg, diabetes mellitus)	Genetic syndrome, exposure to ionising radiation/chemotherapy
Clinical features	Pain related to hip or referred, mechanical symptoms (eg, clicking), related to activity (eases with rest)	Groin/thigh pain that improves throughout the day, chronic onset, systemic findings (eg, rash, uveitis)	Acute localised onset of severe pain, refusal to weight bear, systemically unwell (eg, fevers)	Insidious onset of pain (including night pain, unrelated to activity) $\pm$ mass, systemic symptoms (eg, weight loss)
Laboratory features	Normal laboratory evaluation including acute phase reactants	WBC may be slightly elevated, CRP <20 mg/L	Raised inflammatory markers (WBC, CRP, ESR). Isolation of pathogen via blood, fluid or bone samples	Raised ALP $\pm$ LDH. Anaemia may be present. Normal or mildly elevated inflammatory markers (CRP, ESR)
Imaging	Plain radiographs often sufficient to diagnose or exclude underlying cause	Plain radiographs usually normal; USS/MRI to rule out other causes	Plain radiographs normal early in disease; MRI to aid in diagnosis or operative planning	Radiographs may show poorly or well-defined lytic/sclerotic areas, periosteal reaction, cortical destruction, etc. MRI to define tumour extent. CT for staging

ALP, alkaline phosphatase; CRP, C reactive protein; ESR, erythrocyte sedimentation rate; LDH, lactate dehydrogenase; USS, ultrasound scan; WBC, white blood cells.

OVIVA study has suggested that early oral antibiotic therapy may be non-inferior to intravenous therapy when comparing overall treatment.¹⁵ In addition, the adjunctive rifampicin for *Staphylococcus aureus* bacteraemia (ARREST) study has proposed that adjunctive rifampicin may provide no additional benefit to conventional antibiotic therapy in confirmed *S. aureus* bacteraemia.¹⁶

Prompt and adequate treatment normally results in good long-term outcomes, though follow-up should be long enough to ensure good return to function and to identify any potential complications. The most common complications include avascular necrosis, limb-length discrepancy, pathological fractures and organ failure.¹⁷

Learning points

- Have a wide differential and high index of suspicion for children presenting with hip pain.
- Infective causes remain the most common cause for an antalgic gait across all age groups.
- Where joint function and range of motion is preserved early, the underlying pathophysiological process may still be infective, specifically osteomyelitis.
- Biochemical investigations may aid diagnosis but early MRI imaging remains the gold standard investigation for osteoarticular infections.
- Prompt treatment with antibiotics $\pm$ surgical intervention improves outcomes.

Contributors All authors contributed equally to the conception and design of the case report. IJ was the principle author, with CU and VD contributing towards editing and preparation of the final manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Riise ØR, Kirkhus E, Handeland KS, *et al.* Childhood osteomyelitis—incidence and differentiation from other acute onset musculoskeletal features in a population-based study. *BMJ Pediatr* 2008;8:45.
- 2 Dartnell J, Ramachandran M, Katchburian M. Haematogenous acute and subacute paediatric osteomyelitis: a systematic review of the literature. *J Bone Joint Surg Br* 2012;94:584–95.
- 3 Zvulunov A, Gal N, Segev Z. Acute hematogenous osteomyelitis of the pelvis in childhood: diagnostic clues and pitfalls. *Pediatr Emerg Care* 2003;19:29–31.
- 4 Klein JD, Leach KA. Pediatric pelvic osteomyelitis. *Clin Pediatr* 2007;46:787–90.
- 5 Kocher MS, Zurakowski D, Kasser JR. Differentiating between septic arthritis and transient synovitis of the hip in children: an evidence-based clinical prediction algorithm. *J Bone Joint Surg Am* 1999;81:1662–70.
- 6 Lew DP, Waldvogel FA. Osteomyelitis. *The Lancet* 2004;364:369–79.
- 7 Davidson D, Letts M, Khoshhal K. Pelvic osteomyelitis in children: a comparison of decades from 1980–1989 with 1990–2001. *J Pediatr Orthop* 2003;23:514–21.
- 8 Dodwell ER. Osteomyelitis and septic arthritis in children: current concepts. *Curr Opin Pediatr* 2013;25:58–63.
- 9 Robertson AJ, Firth GB, Truda C, *et al.* Epidemiology of acute osteoarticular sepsis in a setting with a high prevalence of pediatric HIV infection. *J Pediatr Orthop* 2012;32:215–9.
- 10 Pineda C, Espinosa R, Pena A. Radiographic imaging in osteomyelitis: the role of plain radiography, computed tomography, ultrasonography, magnetic resonance imaging, and scintigraphy. *Semin Plast Surg* 2009;23:080–9.
- 11 Kothari NA, Pelchovitz DJ, Meyer JS. Imaging of musculoskeletal infections. *Radiol Clin North Am* 2001;39:653–71.
- 12 Gafur OA, Copley LA, Hollmig ST, *et al.* The impact of the current epidemiology of pediatric musculoskeletal infection on evaluation and treatment guidelines. *J Pediatr Orthop* 2008;28:777–85.
- 13 Pineda C, Vargas A, Rodríguez AV. Imaging of osteomyelitis: current concepts. *Infect Dis Clin North Am* 2006;20:789–825.
- 14 Highland TR, LaMont RL. Osteomyelitis of the pelvis in children. *J Bone Joint Surg Am* 1983;65:230–4.
- 15 Li HK, Rombach I, Zambellas R, *et al.* Oral versus intravenous antibiotics for bone and joint infection. *N Engl J Med* 2019;380:425–36.
- 16 Thwaites GE, Scarborough M, Szubert A, *et al.* Adjunctive rifampicin for *Staphylococcus aureus* bacteraemia (ARREST): a multicentre, randomised, double-blind, placebo-controlled trial. *Lancet* 2018;391:668–78.
- 17 Sukswai P, Kovitvanitcha D, Thumkunanon V, *et al.* Acute hematogenous osteomyelitis and septic arthritis in children: clinical characteristics and outcomes study. *J Med Assoc Thai* 2011;94(Suppl 3):S209–16.

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