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Magnetic resonance imaging features of hip disorders in an Egyptian pediatric population

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SUMMARY

Hip disorders in a pediatric population are a diagnostic challenge. The aim of the study is to assess the role of magnetic resonance imaging (MRI) in the evaluation of non-traumatic hip disorders in a series of Egyptian patients and to review the literature on the most common hip conditions.

Seventy two consecutive patients [40 males (55.6%) and 32 females (44.4)] with acute onset of hip complaints unrelated to trauma or falls were recruited. All patients underwent an initial full clinical assessment and blood tests as well as contrast enhanced MRI of both hips.

The most common diagnosis in this group of Egyptian patients was transient synovitis in 29 (40.3%) cases, followed by seronegative enthesopathy and arthropathy syndrome in 8 (11.1%), septic arthritis in 10 (13.9%), tuberculous arthritis in 4 (5.6%), sickle-cell disease in 7 (9.7%), complicated with septic arthritis in 3 (4.2%), transient bone marrow edema (BME) in 3 (4.2%), osteomyelitis in 2 (2.8%), osteosarcoma in 2 (2.8%), sciatic nerve injury in 1 (1.4%), leukemia with BME in 1 (1.4%), coxa vara of both hips and L5/S1 facet joint ankylosis in 1 (1.4%), and a benign bone cyst in 1 (1.4%). MRI studies showed hip effusion in a total of 51 patients (70.8%), joint space narrowing in 9 (12.5%), and BME in 15(20.8%).

MRI is a sensitive tool for assessing hip disorders in a pediatric population and can play an important role in both diagnosis and management of different hip disorders, irrespective of the underlying pathology.

Key words: *Pediatric hip disorders; magnetic resonance imaging of hip; transient synovitis; seronegative enthesopathy and arthropathy; sickle-cell disease; camptodactyly-arthropathy-coxavara-pericarditis syndrome.*

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INTRODUCTION

Non-traumatic hip pain in children can be a diagnostic challenge all over the world. The incidence of hip diseases is different in western countries compared with Egypt. Pediatric hip diseases also vary depending on the age of patients. Young children may have hip pain related to transient synovitis, septic arthritis, or Legg-Calvé-Perthes disease.

Older children are more likely to suffer from slipped capital femoral epiphysis or apophyseal avulsion fractures without clinical trauma. Knowledge about how the growing skeleton differs from the one of adults as well as the classic imaging findings in many of these diagnoses is paramount in the treatment of pediatric patients with suspected hip disease (1, 2).

Hip pathology may cause groin pain, referred thigh or knee pain, reluctance to bear weight or altered gait patterns. Transient synovitis is one of the most common causes of hip pain in children, and must be differentiated from septic arthritis.

In particular, a young child with hip pain may pose a diagnostic challenge. Transient

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synovitis and septic arthritis may have similar presentations with a spontaneous onset of progressive hip, groin, or thigh pain; limp or inability to bear weight, fever; and irritability.
Transient synovitis is a self-limiting condition with no recognized long-term sequelae and typically has an acute onset, and spontaneous recovery with no radiological abnormality or systemic upset. It occurs between the age of 2 and 10 years (peaking between 5 and 6 years) and is more common in boys (3, 4).
Hip disease may develop in 30-50% of children with juvenile idiopathic arthritis (JIA) and is usually bilateral (5). It is very uncommon for a child to present with hip monoarthritis as the initial manifestation of JIA (2).
Initial radiographs may be normal or show regional soft tissue swelling and osteopenia, while MRI can best assess early disease findings of synovial proliferation and cartilage erosions. Hip MRI might be considered for inclusion in the study protocol of patients with JIA, since it detects joint involvement at early stages and provides a detailed evaluation of the extent of the joint disease (6).
Radiographs, ultrasound and MRI are the most common imaging tools used to assess the pediatric hip. Typically the first line of imaging investigation consists of hip radiography and ultrasonography (US) (2). MRI can be extremely helpful, but it has a significant drawback, as immobility is required during the examination.
In a previous study, MRI showed good sensitivity and specificity in the investigation of acute hip pain in children and appeared to be more accurate than US and plain radiographs (7).
MRI has indeed the advantage of providing a detail view of articular and physeal cartilage, subchondral bone, periosteum, synovium and bone marrow elements of the hip (2).
The aim of this study is to assess the role of MRI in the evaluation of non-traumatic hip disorders in a series of Egyptian patients and to review the literature on the most common hip conditions.

PATIENTS AND METHODS

In a prospective study, all children presenting with acute non-traumatic hip pain were included consecutively between January 2012-July 2014. All cases were followed up for at least six months. There were no dropouts. Plain radiographs and MRI of the hips were performed in all patients. Baseline routine laboratory investigations included erythrocyte sedimentation rate (ESR) first hour (mm/h), C-reactive protein (CRP) levels (mg/dL), complete blood count, complete liver and kidney function tests, urine analysis and additional tests depending on the clinical findings.

Magnetic resonance imaging protocol
A General Electric 1.5 TESLA MR Unit with a dedicated surface hip coil was used in all MR hip studies. In all patients conscious sedation was performed. The mother or the father was allowed to stand next to the child during the procedure. After the acquisition of sets of transverse T1-weighted scout MR images and comparative coronal T1-weighted MR images of both hips, coronal T1-weighted images of the symptomatic hip/hips were systematically obtained using a surface coil wrapped around the symptomatic hip/hips. Sagittal T1- weighted images were obtained on a plane with approximately 10° of internal rotation with respect to the plane perpendicular to the femoral neck. T1-fast spin-echo-weighted images were obtained with the following parameters: repetition time ms 350-550/echo time ms 20-25, 14- to 20-cm field of view, 3.5- to 5.0-mm section thickness, 0.5-mm intersection gap, two to four signals acquired, and a 230×256 matrix. Coronal or sagittal images were obtained as necessary, depending on the topography of the marrow changes on the T1-WI. T1-w images were re-obtained after a 0.1 mmol/kg dose of gadolinium was administered (8).

Image analysis and interpretation
All MR images were analyzed by an experienced musculoskeletal radiologist (YR) paying special attention also to the follow-

Table I - Demographic data, associated clinical features and final diagnosis in the group of patients in the study.

Variable (n=72)	Value
Age in years (mean±SD)	8.26±3.681
Gender Male, n (%) Females, n (%)	 40 (55.6) 32 (44.4)
Disease duration in months (mean±SD)	4.417±4.838
Fever, n (%)	21 (31.3)
Weight loss, n (%)	8 (11.9)
Bilateral hip involvement, n (%)	19 (26.4)
Unilateral hip involvement, n (%)	53 (73.6)
Peripheral arthritis, n (%)	4 (5.9)
Tenosynovitis, n (%)	2 (2.9)
Sacroiliitis, n (%)	8 (11.1)
ESR 1st hour (mm/h)	21.403±22.787
CRP (mg/dL)	7.085±11.419
HLA-B27 positive	4 (5.6)
SEA syndrome, n (%)	8 (11.1)
Transient synovitis, n (%)	29 (40.3)
Septic arthritis, n (%)	10 (13.9)
Tuberculous arthritis, n (%)	4 (5.6)
SCD, n (%)	7 (9.7)
Ischiofemoral impingement, n (%)	1 (1.4)
Septic arthritis on top of SCD, n (%)	3 (4.2)
Osteomyelitis, n (%)	2 (2.8)
Malignant tumors, n (%)	2 (2.8)
Sciatic nerve injury, n (%)	1 (1.4)
Osteomyelitis and SCD, n (%)	2 (2.8)
Leukemia, n (%)	1 (1.4)
CACP syndrome, n (%)	1 (1.4)
Benign bone cyst, n (%)	1 (1.4)
Transient bone marrow edema, n (%)	3 (4.2)
Peri-articular cold abscess, n (%)	2 (2.8)

SD, standard deviation; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; SEA, seronegative enthesopathy and arthropathy; SCD, sickle cell disease; CACP, Camptodactyly-arthropathy-coxavara-pericarditis.

Table II - Magnetic resonance imaging features among the group of patients in the study

MRI signs	Number (%)
Hip effusion	51 (70.8)
Joint space narrowing	9 (12.5)
BME	15 (20.8)
Bone infarct on top of SCD, n (%)	1 (1.4)
Osteonecrosis on top of SCD, n (%)	3 (4.2)
Cartilage denudation	11 (15.3)
Soft tissue abnormalities	14 (19.4)
Periarticular collection	9 (12.5)
Peri-articular soft tissue lesion	14 (19.4)
Synovial enhancement	32 (44.4)
Facet joint bony ankylosis	1 (1.4)

MRI, magnetic resonance imaging; BME, bone marrow edema; SCD, sickle cell disease.

ing articular features: cartilage morphology, subchondral bone marrow lesions, subchondral cysts, osteophytes, acetabular labrum, synovitis, joint effusion, loose bodies, dysplasia, and trochanteric bursitis/insertional tendonitis of the greater trochanter. The findings were discussed with the clinicians treating the patients.

Statistical analysis

Data were coded and summarized using SPSS version 12.0 for Windows (IBM Corp., Armonk, NY, USA). Quantitative variables were described using mean±standard deviation and categorical variables with absolute values and percentages.

Ethics

The local ethical committee approved the study design. The details of the study were explained to (the parents of) all patients and written informed consents were obtained from all participants prior to the study.

RESULTS

Seventy-two consecutive children with acute onset of non traumatic hip(s) pain were included. Nineteen of them had a bilateral hip involvement. The demographic features, disease characteristics, laboratory findings and final diagnoses for the study group are reported in detail in Table I.

MRI studies showed hip effusion in a total of 51 (70.8%) cases (Figures 1A, 1D, 1E, 2A, 2B, 2C, 2D, 4A, 5E), joint space narrowing in 9 (12.5%), cold abscesses due to tuberculous arthritis (TB) in 4 (5.6%) (Figures 5A, 5B, 5C), BME in 15 (20.8%) (Figures 2B and 4E), bone infarction on top of sickle-cell disease (SCD) in 1 (1.4%), soft tissue abnormalities in 14 (19.4%) (Figures 4A, 4B, 4D, 5A, 5B, 5C, 5E), and synovial enhancement in 32 (44.4%) (Figures 1A, 1D, 1E, 2A, 2D, 4A, 5B, 5C, 5E). Avascular necrosis at different stages in % (Figure 3A-C). Miscellaneous hip disorders are shown in figure 4, including old neglected right femoral head dislocation (Figure 4A), iatrogenic nerve

injury after incorrect intramuscular injection (Figure 4B), benign bone cyst (Figure 4C), osteosarcoma (Figure 4D) and lymphocytic leukemia (Figure 4E).

DISCUSSION

Hip disease in pediatric patients can be very challenging to diagnose due to the large number of potential variables to consider. Categorizing children by age can be useful to speed up the process and reach an early diagnosis, which is particularly important in cases of severe pediatric hip disease (9). MRI combined with inflammatory markers can be used to identify children who require aggressive early management (7).

The hip disorders in our series of North African patients are different from those of western countries. Although it is not an epidemiologic study, since this is a prospective series studied in a regional hospital, it is likely to reflect the incidence of the different diagnosis in northern Egypt. In this series transient synovitis was the most frequent diagnosis in 29 (40.3%) cases, seronegative enthesopathy and arthropathy (SEA) syndrome in 8 (11.1%), septic arthritis in 10 (13.9%), TB arthritis in 4 (5.6%); SCD in 7 (9.7%), of which 3 complicated by septic arthritis (4.2%), and 2 by osteomyelitis (2.8%). It is remarkable that none of the patients had JIA and Legg-Calvé-Perthes disease.

Transient synovitis and septic hip arthritis in children

Transient synovitis and septic arthritis manifest similar early symptoms. Untreated intra articular infection can lead to a permanent loss of hip function, therefore it is extremely important to differentiate potential infection from benign cases of transient synovitis (2). Laboratory tests are necessary to exclude septic arthritis in young, febrile or unwell children and adolescents. Complete blood count, ESR or CRP, blood and joint cultures should be performed, if infection is suspected. Cultures of joint and synovial fluid should be put in a BACTEC culture to optimize

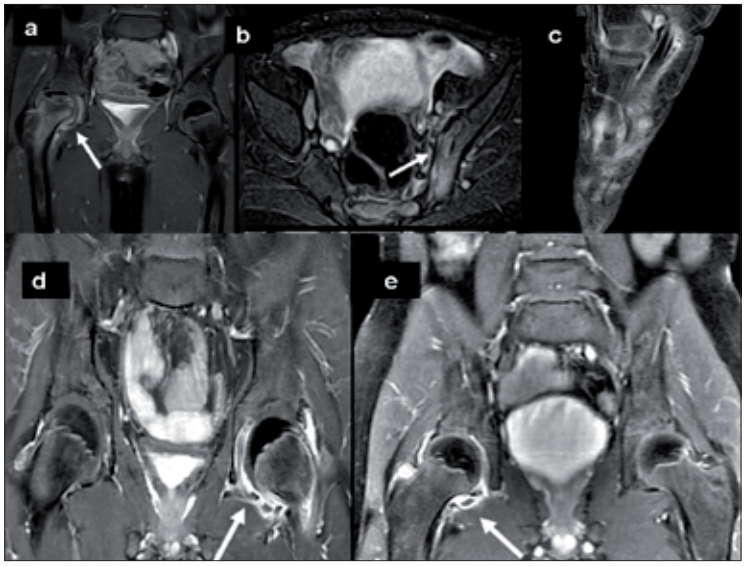

Figure 1 - Seronegative enthesopathy and arthropathy (SEA) syndrome. A) Coronal short tau inversion recovery (STIR) Fat Sat showing synovial thickening of right hip (white arrow); B) STIR sequence showing left-sided sacroiliitis in a case of SEA syndrome and associated bone marrow microenvironment (white arrow); C) Sagital T1 Fat Sat showing flexor tenosynovitis in middle finger of a SEA syndrome case; D) Post contrast T1 fat sat showing mild left hip joint effusion with synovial enhancement in a case of SEA syndrome (white arrow); E) Post contrast T1 Fat Sat also showing evidence of right hip synovitis and synovial enhancement (white arrow).

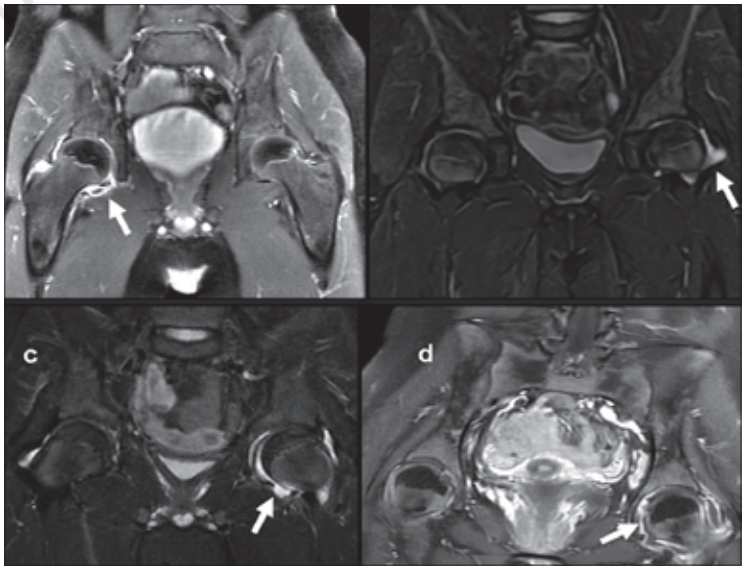

Figure 2 - Transient synovitis. A) Post contrast coronal T1 Fat Sat showing right hip effusion with synovial enhancement (white arrow); B) Coronal T2 Fat Sat showing left sided hip effusion (white arrow); C) Coronal T2 Fat Sat showing bilateral hip effusion more on the left side (white arrow); D) Post contrast coronal T1 Fat Sat showing synovial thickening and enhancement (white arrow).

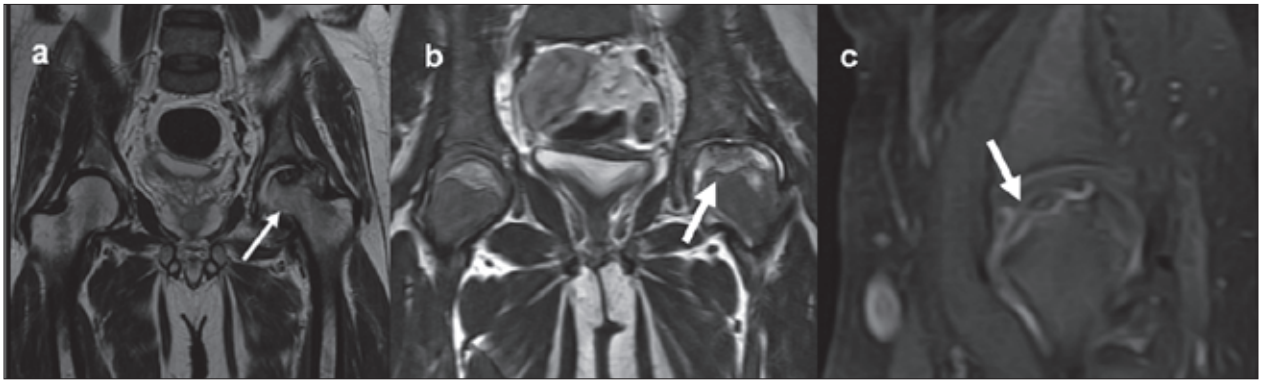

Figure 3 - Sickle cell disease. A) Post contrast coronal T1 Fat Sat showing collapsed right femoral head (white arrow) with femoral neck edema and reactive synovitis stage III avascular necrosis (AVN); B) Coronal T2 Fat Sat showing stage II AVN of the left femoral head (white arrow); C) Sagittal T1 Fat Sat post contrast showing stage III AVN (white arrow).

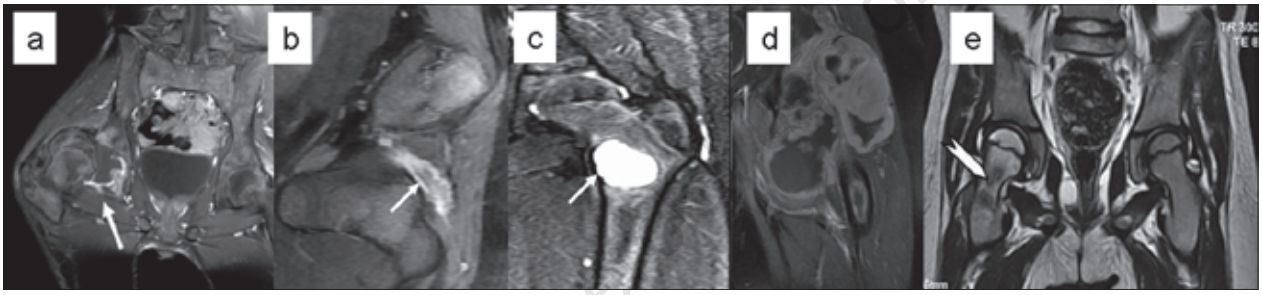

Figure 4 - Miscellaneous hip disorders. A) Axial T2 fat sat showing lateral and posterior previously neglected right femoral head dislocation (white arrow); B) Sagittal post contrast T1 fat sat showing thickening and enhancement of a left sciatic iatrogenic nerve injury after wrong intramuscular injection (white arrow); C) Left hip coronal T2 fat sat showing femoral neck unicameral cyst having bright homogenous signal intensity (white arrow); D) Post contrast T1 Fat Sat of the left hip showing soft tissue mass with multi-lobulation in a case of osteosarcoma; E) Coronal short tau inversion recovery and T2WI showing right femoral low signal infiltrates (white arrows) with diffuse bone marrow edema of right side in a case of lymphocytic leukemia.

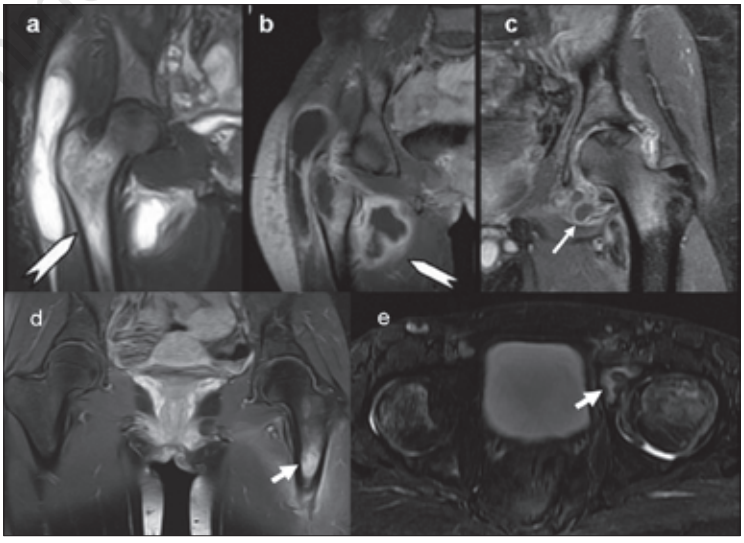

Figure 5 - A) Coronal T2 WI showing cold abscess and bone marrow edema of the femoral neck (white arrow) in a case of tuberculous arthritis (TB); B) T1 WI post-contrast Fat Sat showing multilocular abscess cavities in a case of TB arthritis (white arrow); C) T1 WI post-contrast Fat Sat showing multilocular abscess cavities in another case of TB arthritis (white arrow); D) Coronal T2 weighted image showing osteomyelitis of the left femoral shaft (white arrow); E) Axial T2 Fat Sat showing left hip septic arthritis with edema and erosions of the femoral head and acetabulum (white arrow).

detection of clinically significant microorganisms (10).

The differentiation between septic arthritis and transient synovitis of the hip in children can be difficult. In 1999, Kocher et al. (11) introduced four clinical predictors which were highly predictive (99.6%) of septic arthritis. These included fever (temperature > or =38.5°C), inability to bear weight, white blood-cell count >12.0x10^9 cells/L and ESR > or = 40 mm/h; CRP > or = 20 mg/L was added later as a fifth predictor. When all five were positive, the predicted probability of septic arthritis in this study was only 59.9%, with fever being the best predictor. When applied to low-prevalence diseases, even highly specific tests yield a high number of false positives and the predictive value is thereby diminished (12).

Other clinical predictive algorithms are used to differentiate transient synovitis from septic arthritis. They typically include ESR, which, however, in the clinical practice, has been largely replaced by the measurement of CRP. Singhal et al. (13) reviewed the records of 311 children with a hip effusion confirmed by ultrasound [mean age 5.3 years (0.2 to 15.1)], which healed in 269 of them without intervention and long-term sequelae and were considered to be associated with transient synovitis. The remaining 42 underwent arthrotomy, because of suspected septic arthritis. Infection was confirmed in 29 (18 had micro-organisms isolated and 11 had a high synovial fluid white-cell count). The remaining 13 patients showed no evidence of infection and were also considered to have had a transient synovitis. In total 29 hips were categorized as septic arthritis and 282 as transient synovitis. Temperature, weight-bearing status, peripheral white-blood cell count and CRP were reviewed in each patient. A CRP >20 mg/L was identified as the strongest independent risk factor for septic arthritis (odds ratio 81.9, p<0.001).

MRI signal intensity alterations in the bone marrow of the affected hip joint are useful to differentiate septic arthritis from transient synovitis. Decreased perfusion at the femoral epiphysis on fat-suppressed gadolinium-enhanced coronal T1-weighted MRI is an indication of septic arthritis (14). In another study, 18 patients [septic arthritis (*n*=7) and transient synovitis (n=11)] underwent dynamic contrast enhanced (DCE) MRI. The authors observed that 6 out of 7 patients with septic arthritis in the hip joint had a decreased enhancement during the early phase of DCE-MRI. They also found a statistically significant difference in enhancement between the two groups of patients (p=0.0498) (15).

In another study, Kwack et al. (16) observed that low signal intensity on fat-suppressed gadolinium-enhanced T1-weighted coronal MRI suggesting decreased perfusion at the femoral head of the affected hip joint was seen in 8 out of 9 patients with septic arthritis and in 2 out of 11 patients with transient synovitis. Alterations in signal intensity in the bone marrow were seen in three patients with septic arthritis, yet in none of the patients with transient synovitis.

Seronegative enthesopathy and arthropathy syndrome and juvenile idiopathic arthritis

In our series the SEA syndrome was observed in 8 cases (11.1%), and none had JIA. It can be challenging to detect spondyloarthropathy (SpA) in children and distinguish it from other forms of JIA. In the early 1980s Rosenberg and Petty reckoned the need to define specific classification criteria and proposed the concept of SEA syndrome. This syndrome shas been defined as enthesitis with arthralgia and/or arthritis in children under 17 years of age who also lack rheumatoid factor and antinuclear antibodies (17). The features of the SEA syndrome helped distinguish SpA from other forms of juvenile arthritis, classified at the time as JIA, without relying on the evidence of any axial involvement. Despite the overall improvement in the classification of juvenile arthritis using the International League of Associations for Rheumatology (ILAR) criteria, the entity of pediatric SpA remains problematic in many respects. Many rheumatologists view SpA in children and adults as a

continuum. However, the category of enthesitis-related arthritis excludes patients with psoriasis or even those with a family history of psoriasis. Children with arthritis and dactylitis or nail pitting belong yet to a different category of psoriatic arthritis, even in the absence of psoriasis (18).

In an earlier study, Olivieri et al. (19) found that only 1 out of 11 patients with the SEA syndrome developed ankylosing spondylitis after a five-year follow up. In a long term follow up study Thierry *et al.* (20) examined 36 out of the 39 children originally described with the SEA syndrome and those followed for a mean of 11 years after symptom onset were found to have had a widely varied clinical course. Twelve of the 23 patients (52%) who originally did not have SpA developed definite (n=6) or probable (n=6) SpA. The development of a definite SpA was associated with HLA-B27 (p=0.0004) and the presence of arthritis (rather than arthralgia only) at the time of the original report (p=0.05). In another study of patients with arthritis, the development of SpA was associated with the onset of arthritis after 5 years of age (p=0.01).

We had no cases of JIA in our series. The incidence and prevalence of JIA varied greatly among published reports due to methodological issues and the classification used (21). Anti-CCP antibodies were prevalent among JIA patients with polyarticular patterns compared to other disease patterns (22). Murray et al. (23) assessed the value of contrast-enhancement in MR diagnosis of hip joint disease in patients with JIA. The authors examined a total of 14 hips in 7 children with JIA. They found pannus in 14 out of 16 hip MR scans, which was associated with articular cartilage destruction in all cases, and joint pain in 13 out of 14 MRI scans. The authors recommended the use of enhanced MR for detection of disease activity and extent in children with JIA affecting the hip.

Sickle-cell disease

SCD is seldom seen in Western series as a cause of acute non traumatic hip complaints. SCD is an autosomal-recessive disorder that causes hemolytic anemia related to abnormal hemoglobin and erythrocytes. Children who are homozygous for the sickle cell gene (hemoglobin SS) have a high risk of infection resulting, as it is associated with recurrent episodes of intestinal mucosa sloughing resulting in enteric bacteremia. Additionally, these children have a high risk of osteonecrosis caused by microvascular occlusion. Its incidence is also high in children with hemoglobin SC (compound heterozygotes for HbS- and HbC-producing alleles: SC) and in those with various types of the sickle-β-thalassemia (SThal) (24).

Osteomyelitis may occur in up to 18% of SCD patients, while septic arthritis in 7% of them according to a previous work (25). This increased incidence of septic arthritis and osteomyelitis as compared to the general population is due to abnormal red blood cells which reduce the blood flow in small vessels, thus causing relative ischemic zones (26).

The immunological response is less effective in areas of impaired vascularity. Additionally, hyposplenism resulting from autosplenectomy in SCD can also result in a degree of immunosuppression (27). Osteomyelitis is most common in the diaphyses of long bones. There is an increased incidence of salmonella osteomyelitis in sickle-cell patients, where it is believed to be the most common pathogen followed by *Staphylococcus aureus* (28).

The classical clinical findings of pain, fever, and raised inflammatory markers can also be seen in infarction, which can cause diagnostic difficulty (29).

Because the presenting history is not typical and diagnosis can be delayed, it is important to maintain a high index of suspicion in patients with SCD who have joint pain and fever. Patients with SCD and septic arthritis superimposed on osteonecrosis were particularly difficult to diagnose unless there was a high index of suspicion. However, the incidence of septic arthritis in adults with SCD is low, but it often is associated with osteomyelitis or osteonecrosis. This picture can be associated with the presence of transphyseal vessels in

children younger than 18 months and the intraarticular location of the metaphysis in joints, such as the hip (27).

Keeley and Buchanan (30) suggested that acute long-bone infarction occurred at least 50 times more frequently than bacterial osteomyelitis or arthritis in patients with SCD.

An abnormal shape of red cells blocking capillaries results in bone infarction in both the diaphyses with ensuing medullary infarcts and in the epiphyses with the appearance of avascular necrosis. This can present as the classical painful bone crisis (27). The clinical features of long bone infarction in patients with SCD have not yet been defined fully, hence it is still difficult to differentiate bone infarct from osteomyelitis.

Keeley and Buchanan (30) reviewed records from 192 children with sickle hemoglobinopathies and identified 41 episodes of acute long bone infarction in 21 patients. The most commonly affected bones were humerus (38%), tibia (23%), and femur (19%). The distal segment was more commonly involved. Tenderness and prominent swelling occurred in all cases; other findings included impaired joint motion (68%), local heat (65%), and erythema (145).

In a more recent study Skaggs et al. (31) found that osteomyelitis can be differentiated from bone infarction in children with SCD and acute bone pain by performing a combination of sequential bone-marrow and bone scintigraphy. Indeed the clinical presentations of the two conditions are similar and imaging and laboratory studies are of limited value in this domain. Sy et al. (32) reported in two cases known to have SCD a rare association with skeletal fluorosis that typically manifests as a diffuse increase in bone density. The authors suggested that the bone lesions due to SCD and those due to fluorosis can mimic other bone diseases, most notably metastases. The combination of SCD and fluorosis results in significant medullary canal narrowing due to cortical thickening and accumulation of necrotic bone.

In our series 4 patients had TB arthritis (5.6%). This is also rare in western series, but it is quite prominent in developing countries, like India. Other diagnoses in our series are less specific for North Africa: osteosarcoma in 2 cases (2.8%), sciatic nerve injury in 1 (1.4%), leukemia with BME in 1 (1.4%), coxa vara of both hips and L5/S1 facet joint ankylosis in 1 (1.4%), benign bone cyst in 1 (1.4%), and transient BME in 3 (4.2%). MRI studies showed hip effusion in a total of 51 (70.8%) cases, joint space narrowing in 9 (12.5%) and BME in 15 (20.8%).

It is remarkable that we saw no cases of Legg-Calvé-Perthes disease or slipped capital femoral epiphysis in older children.

This study has certain weaknesses, as it is not an epidemiological study, but it only provides an insight of the prevalence of hip disorders in northern Egypt. Other Arab countries are likely to have comparable figures. We did not perform ultrasound in all cases, because a comparison between the two methods was not within the scope of this study.

Conversely, this study has also some pluses, as it is conducted on a large series in an Arab country. It is a prospective series of a regional hospital, thus showing the types of disorders encountered. As we had no dropouts, the series is very complete. Also the type of disorders differs from those seen in Western countries and we have many clear pictures of the MRI findings.

CONCLUSIONS

Accurate and early diagnoses of acute nontraumatic pediatric hip disorders are important, because misdiagnosis or late diagnosis may lead to serious potential complications, and inevitable structural damage in adult life irrespective of the underlying hip pathology.

MRI is a very important diagnostic tool and can precisely delineate the underlying hip pathology. Additionally, it seems mandatory in case of suspected hip disease with persistent symptoms and normal plain radiographs.

All the authors responsible for this work report to have no conflicts of interest.

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