



# Improving the management of the child with an unexplained limp

M. Lalanda

*Accident and Emergency Department, Leeds General Infirmary, Leeds, UK, and*

J.A. Alonso

*Orthopaedics and Trauma Department, Hope Hospital, Salford, UK*

## Abstract

**Purpose** – A clinical governance project is set up following the delayed diagnosis of two children with life-threatening conditions (osteomyelitis and Ewing's sarcoma). They attended A&E with a simple limp. The aim is to improve the management of this very common presentation. With this purpose, a series of algorithms was created and then its use with a prospective study assessed

**Design/methodology/approach** – The study was carried out for nine months. A total of 113 children were included in it. Some 65 per cent were diagnosed, treated and followed up by the A&E department exclusively. Only 15 per cent required hospital admission. No hip aspirations were required to diagnose septic arthritis, as the exclusion of this condition was based on the four predicting factors (pyrexia, raised WCC, raised PV and CRP and fluid in the hip joint demonstrated by hip ultrasound).

**Findings** – It is believed that the management of this group of children is greatly improved.

**Originality/value** – The protocol presented in this study is cost-effective as unnecessary hospital admissions are avoided, fewer patients are referred to specialised clinics and appropriate use of the radiology service is made out of hours. Diagnosis and treatment of serious conditions such as septic arthritis, or Perthe's disease, does not get delayed.

**Keywords** Children (age groups), Orthopaedics, Hospitals

**Paper type** Research paper

## Introduction

During the last months of 2002, we had two patients whose treatment was delayed due to misdiagnosis. A 15-year-old girl attended with an unexplained groin pain and no other symptoms. A diagnosis of muscular sprain was made following examination. The patient was discharged home with no follow up. Three months later reattended as the symptom persisted. A pelvic X-ray was performed, followed by a CT scan. The diagnosis was that of an abdomino-pelvic Ewing's sarcoma. The second case was a 10-year-old girl with knee pain and mild limp. She attended A&E three times over a period of several weeks before any investigations were done. A diagnosis of osteomyelitis was finally made. She was subsequently taken to theatre where a large amount of pus was aspirated from her tibia.

A limping child presenting to the Accident and Emergency (A&E) department with no clear history of trauma is a common and challenging problem. The underlying causes can be self limited in time or leading to life long sequelae, but both, initially

---

The authors would like to thank Dr R.M. Arthur (Consultant Radiologist at Leeds General Infirmary) and Mr Templeton (Paediatric Orthopaedic Consultant at the Leeds General Infirmary) for their input in the design of the Limping Child Guidelines and Sister Anessa Rush for her invaluable contribution to the data collection.



---

share the clinical picture of limping, avoiding weight bearing and limited leg movements (Fischer, 1999; Mattick, 1999; Marchal, 1987; Kocher, 1999; White, 2001).

This situation presents the danger of missing a serious pathology (i.e. infection (Abbott, 1993), neoplasia, slipped capital femoral epiphysis, Perthes disease) before effective treatment can be offered, but equally, there is the risk of over investigating and over treating children with no significant disease (Kocher, 1999).

Unfortunately there are no national guidelines on the management of this common presentation; there can be a great variation on the use of investigating tools depending on the experience and knowledge of the clinician involved. But the use of these investigations indiscriminately offers unnecessary risks (pelvic radiographs, hip joint aspirations (Fink, 1995)) as well as sub optimal use of resources.

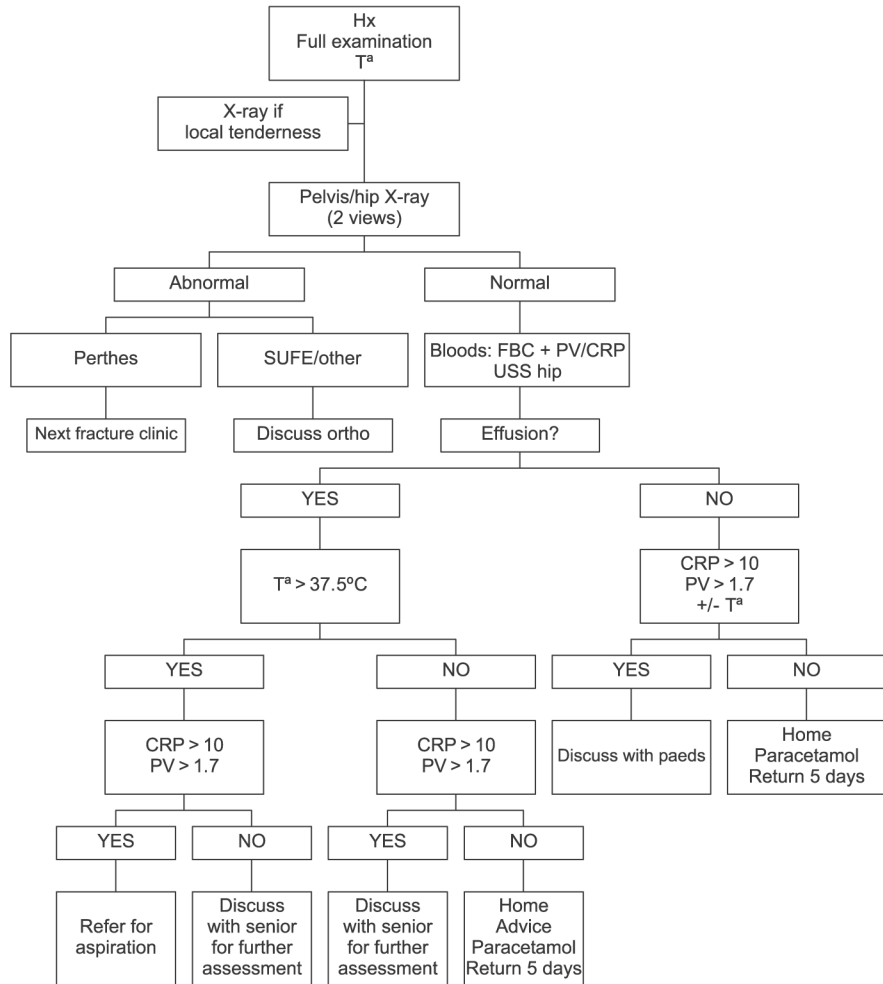
Previous research has determined the diagnostic value of individual test (ultrasound scan (Marchal, 1987; Bickerstaff, 1990; Alexander, 1989; Zawin, 1993; Adam, 1986), magnetic resonance imaging (White, 2001), laboratory tests (Beccaro, 1992) or the combination of several investigations (Kocher, 1999).

Based on the current evidence available we designed an algorithm that guides the investigation and management of a limping child presenting to the A&E department. This algorithm rationalises the diagnostic tests performed in an escalated way, avoiding unnecessary investigations and minimising hospital in-stay, as well as being able to identify serious pathology at the time of attending the A&E department.

## Methods

We conducted a prospective study on all children attending The A&E department at the Leeds General Infirmary between March and November 2003 with a history of un-explained limp. We applied the suggested algorithms (Figures 1 and 2) in all children, less than 16 years old who attended with a limp or painful leg without a history of significant trauma. In order to optimise the services provided by other hospital departments (Radiology, Haematology) Children attending after 5 p.m. (weekdays and weekends) followed the out of hours algorithm (Figure 3). Prior to the use of this protocol the agreement from the Paediatric Sections of the Radiology and Orthopaedic departments was sought.

Our A&E department has a dedicated paediatric area where the children were physically examined. For the purpose of this study they were identified with their individual A&E unit number. The attending doctor to allow prospective data collection filled a form designed for this study. Time of attendance was analysed arbitrarily but conveniently in 5 groups (Table I). Body temperature was considered raised when above 37.5 degrees Celsius at the time of examination in the A&E department using an electronic ear thermometer. Blood test results were recorded as abnormal when the values were higher than  $13 \times 10^3$  per ml for white cell count (WCC), higher than 10 for C reactive protein (CRP), and for plasma viscosity (PV) higher than 1.56 in the patient younger than 3 years old and higher than 1.7 in the older than 3 years. The hip ultrasound scans were performed and reported by one of our two senior Paediatric Radiologist Consultants and when clinically indicated the knee and ankle were also scanned. A Paediatric Radiologist also reviewed plain X-rays. All the case notes were reviewed and details were entered into a database designed for the purpose of this study. The data included demographic details (age and sex), time of attendance (time of

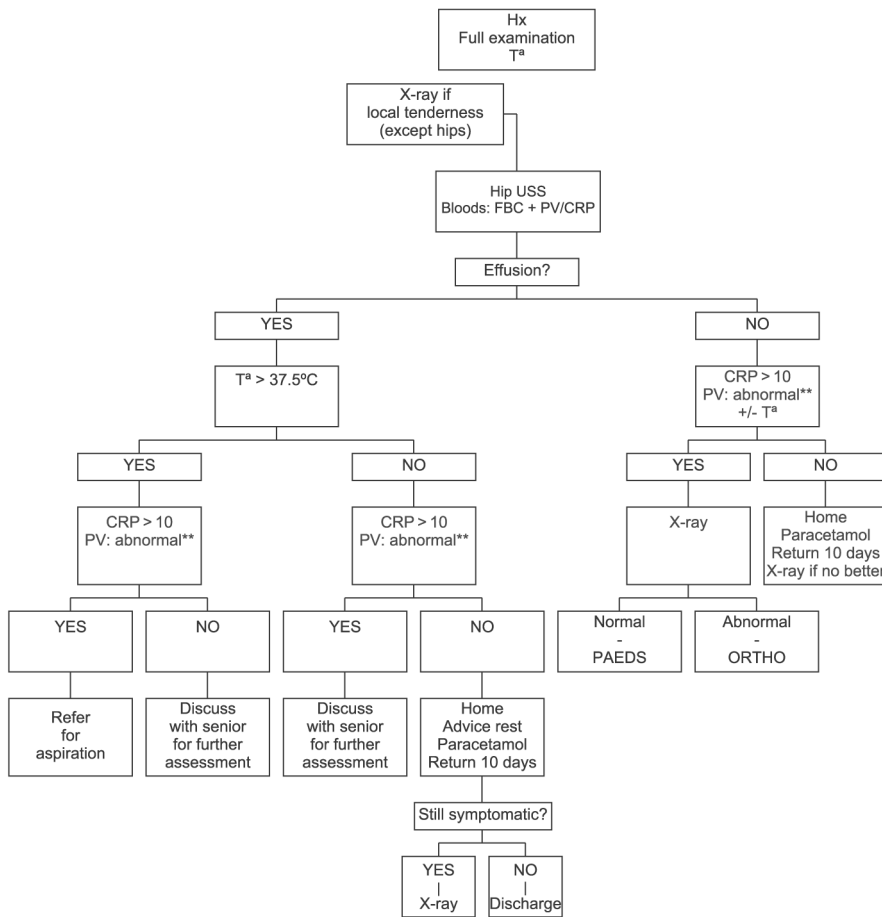


**Figure 1.**  
Algorithm management  
limping child (age > 8  
years old)

day and day of week), body temperature, blood tests results (WCC, PV, CRP), imaging details (ultrasound scan and plain radiographs), diagnosis and outcome.

### Results

During the period of the study, 113 patients in the paediatric age group (less than 16 years of age) attended our A&E department with a history of limp or reluctance to weight bear. Of those included in the study, 65 per cent were male and 35 per cent were female. The age distribution is shown on Table II. Attendance during week days represented 84 per cent of the total study group (95 out of 113 patients) and 16 per cent (18 out of 113) attended during weekends, with no significant difference in attendance during a particular day of the week.

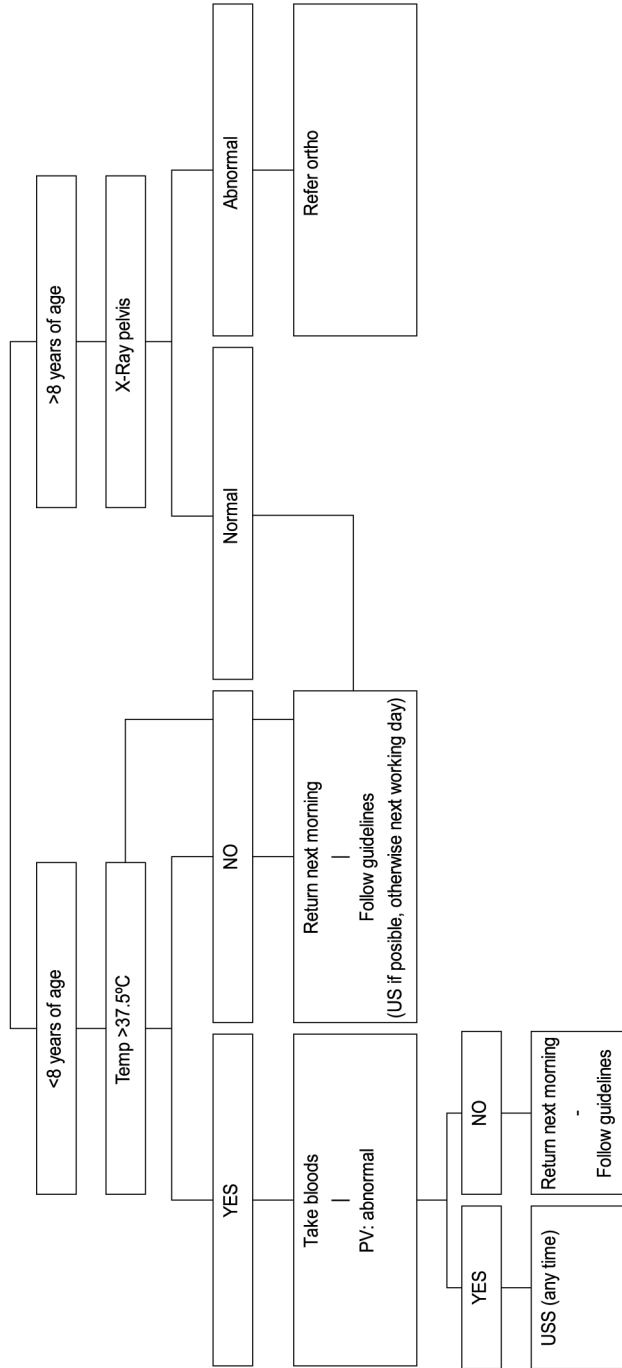


**Figure 2.** Algorithm management limping child (age < 8 years old)

According to the criteria established, 15 per cent of the children in the study were pyrexial on admission. Blood samples for WCC, PV and CRP, were obtained in 96 patients (85 per cent). The results are shown in Table III. Ultrasound scans were performed on 89 patients (64 on the same day and 25 the next day according to the “out of hours” algorithm. The ultrasound scans results are summarised on Table IV. From all the patients included in the study 60 (53 per cent) were X-rayed, of those 40 (35 per cent of the total) had a pelvis X-ray. In six cases the lower limbs were also included in the pelvic films as they were infants in five cases, and because of local tenderness in one case (Table V).

A wide range of pathology was found (Table VI). The most common diagnosis was transient synovitis (“irritable hip” (Hauelsen, 1986)), 50.4 per cent. 17 patients had no final diagnosis, all resolved spontaneously and they were followed up by the A&E (14), orthopaedic (2) and paediatric departments (1).

In our series there was no case of septic arthritis of the hip, this confirms the data published in previous studies (Fischer, 1999) showing the rarity of this condition.



**Figure 3.**  
Algorithm management  
limping child "out of  
hours"

Only 15 per cent (17 children) required hospital admission, the majority (14) under orthopaedic care and 3 under the paediatricians. In 8 cases they were discharged the following day with a diagnosis of transient synovitis.

## Child with an unexplained limp

**313**

Time	Total number	%
00.00-08.00	1	0.9
08.00-12.00	48	42.5
12.00-17.00	37	32.7
17.00-20.00	20	17.7
20.00-24.00	7	6.2

**Table I.**  
Time of attendance

Age (years)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number	2	20	11	16	16	12	8	6	7	2	1	6	1	2	2	1

**Table II.**  
Age distribution

Test	<i>N</i>	Normal	Abnormal
WCC	83	74	9
PV	86	76	10
CRP	80	71	9

**Table III.**  
Blood results

**Note:** *n* – number of patients having a confirmed result on the blood test

Ultrasound report	Number of patients ( <i>n</i> = 89)
Normal	40
Hip effusion	36 (3 bilateral)
Synovial thickening	5
Irregular femoral head	1
Epiphyseal gap	1
Knee effusion	4
Ankle effusion	2

**Table IV.**  
Ultrasound scan results

Area X-rayed	Number of patients ( <i>n</i> = 60)
Pelvis	34
Pelvis and lower limbs	6
Knee	9
Tibia and fibula	5
Ankle	3
Foot	2
Femur	1

**Table V.**  
Area X-rayed

CGIJ 11,4	Diagnosis	Number (N = 113)
<b>314</b>	Chondromalacia patella	1
	Fracture	4
	H-S purpura	2
	Juvenile chronic arthritis	1
	No diagnosis	17
	Osgood-Slatter disease	1
	Osteomyelitis	1
	Perthes disease	3
	Reactive arthritis	10
	Septic arthritis ankle	2
	Soft tissue injury	14
	Transient synovitis	57

**Table VI.**  
Final diagnosis

### Discussion

Management of a child with an unexplained limp offers a diagnostic dilemma. Since there is no single definitive test, several multifactorial algorithms have been proposed to minimize the need of arthrocentesis, a painful procedure often requiring general anaesthetic. Beccaro (1992) recommended that all patients with an irritable hip be considered for diagnostic hip arthrocentesis when there is no identifiable source and the ESR is  $\geq 20$  mm/h or the oral temperature is  $\geq 37.5^\circ\text{C}$ . Eich *et al.* (1999) concluded that a rectal temperature of  $\geq 38^\circ\text{C}$ , an ESR of  $\geq 20$  mm/h, and a CRP of  $\geq 20$  mg/dl are the most important parameters for identifying septic arthritis. Kocher (1999) identified four variable as having a predictive value for septic arthritis: temperature of  $\geq 38.5^\circ\text{C}$ , ESR  $\geq 40$  mm/h, non-weight bearing status and a peripheral white cell count of  $> 12,000$  cells/mm<sup>3</sup>. However when the algorithm developed by Kocher was applied by Luhmann *et al.* (2004) to other patient population its validity was not confirmed, although they recognise that the use of a validated clinical prediction algorithm for septic arthritis of the hip should be able to decrease utilization of health-care resources, minimize the use of painful procedures and unnecessary treatments, and optimize patient outcome.

Using our proposed algorithm 65 per cent of the patients included in this study were diagnosed, treated and followed up by the A&E department exclusively. We believe that this protocol is cost-effective, as unnecessary hospital admissions were avoided, fewer patients were referred to specialised clinics and appropriate use of the radiology service was made out of hours. We observed also a significant reduction of X-rays that would have been obtained in the absence of this protocol. In addition, these management algorithms proved to be safe as no major pathology was missed during the duration of the study. No hip aspirations were required to diagnose septic arthritis, as the exclusion of this condition was based on the four predicting factors (pyrexia, raised WCC, raised PV and CRP and fluid in the hip joint demonstrated by hip ultrasound). Other serious pathology such as Perthes disease, osteomyelitis, or septic arthritis of other joints was diagnosed at the time of attending the department following the algorithms shown in this study.

---

**References**

- Abbott, G.T. (1993), "Pyogenic sacroiliitis, the missed diagnosis", *British Journal of Radiology*, Vol. 66, pp. 120-2.
- Adam, R. (1986), "Arthrosonography of the irritable hip in childhood: a review of 1 year's experience", *British Journal of Radiology*, Vol. 59, pp. 205-8.
- Alexander, J.E. (1989), "High-resolution hip ultrasound in the limping child", *Journal of Clinical Ultrasound*, Vol. 17, pp. 19-24.
- Beccaro, M.A. (1992), "Septic arthritis versus transient synovitis of the hip: the value of screening laboratory tests", *Annals of Emergency Medicine*, Vol. 21, pp. 1418-22.
- Bickerstaff, D.R. (1990), "Ultrasound examination of the irritable hip", *Journal of Bone and Joint Surgery (British volume)*, Vol. 72, pp. 549-53.
- Eich, G.F., Superti-Furga, A., Umbricht, F.S. and Willi, U.V. (1999), "The painful hip: evaluation of criteria for clinical decision-making", *European Journal of Pediatric Surgery*, Vol. 158, pp. 923-8.
- Fink, A.M. (1995), "The irritable hip: immediate ultrasound guided aspiration and prevention of hospital admission", *Archives of Disease in Childhood*, Vol. 72, pp. 110-14.
- Fischer, S.U. (1999), "The limping child: epidemiology, assessment and outcome", *Journal of Bone and Joint Surgery (British volume)*, Vol. 81-B, pp. 1029-34.
- Hauelsen, D.C. (1986), "The characterization of 'transient synovitis of the hip' in children", *Journal of Pediatric Orthopaedics*, Vol. 6, pp. 11-17.
- Kocher, M.S. (1999), "Differentiating between septic arthritis and transient synovitis of the hip in children: an evidence based clinical prediction algorithm", *Journal of Bone and Joint Surgery (American volume)*, Vol. 81-A, pp. 1662-70.
- Luhman, S.J., Jones, A., Schootman, M., Gordon, E. and Schoenecker, P.L. (2004), "Differentiation between septic arthritis and transient synovitis of the hip in children with clinical prediction algorithms", *Journal of Bone and Joint Surgery (American volume)*, Vol. 86-A, pp. 956-62.
- Marchal, G.J. (1987), "Transient synovitis of the hip in children: role of US", *Radiology*, Vol. 162, pp. 825-8.
- Mattick, A. (1989), "Seven year follow up of children presenting to the accident and emergency department with irritable hip", *Journal of Accident and Emergency Medicine*, Vol. 16, pp. 345-7.
- White, P.M. (2001), "Magnetic resonance imaging as the primary imaging modality in children presenting with acute non-traumatic hip pain", *Emergency Medicine Journal*, Vol. 18, pp. 25-9.
- Zawin, J.K. (1993), "Joint effusion in children with an irritable hip: US diagnosis and aspiration", *Radiology*, Vol. 187, pp. 459-63.

**Corresponding author**

M. Lalanda can be contacted at: [lalanda@doctors.org.uk](mailto:lalanda@doctors.org.uk)

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.