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# Slipped upper femoral epiphysis in children

## Delays to diagnosis

### Background

Slipped upper femoral epiphysis (SUFE) is a childhood condition requiring urgent admission for surgery. It is often complicated by delayed diagnosis.

### Method

This study investigated incidence and factors contributing to delayed diagnosis of SUFE, by retrospective and prospective review of children (n=120) presenting to a tertiary institution with SUFE from 2003–2007.

### Results

The delay from initial presentation to a health professional to hospital admission ranged from 0–731 days. Most patients (76%) presented initially to their general practitioner. Of children with stable SUFE, the diagnosis was missed at the initial consultation in 62 (60%) of 103 children, and there was a delay after X-ray to diagnosis of 0–11 days. There were no delays from hip radiograph to confirmation in patients with unstable SUFE.

### Discussion

A child presenting with hip, thigh or knee pain and reduced hip range of movement (particularly internal rotation) on the affected side, should arouse clinical suspicion of SUFE. This should prompt radiographic imaging of the hip with antero-posterior and lateral hip views. This study shows that most children presenting to The Royal Children's Hospital (Melbourne, Victoria) with SUFE from 2003–2007 presented first to their GP and some faced significant delays to diagnosis and admission. These delays are of concern as delays have been shown to result in increased severity of physal slip and poorer long term outcomes. General practitioners play a crucial role in the early recognition and diagnosis of SUFE to ensure timely and appropriate referral and the best possible outcome for the child.

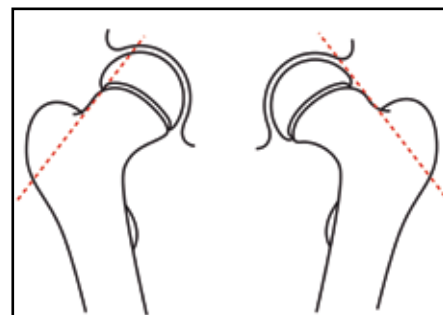
**Keywords:** children; hip joint; epiphyses, slipped; femur head/pathology; delayed diagnosis



Slipped upper femoral epiphysis (SUFE) is a disorder of the paediatric and adolescent hip. It is characterised by displacement of the upper femoral epiphysis from the metaphysis through the physis (*Figure 1, Table 1*). Internationally, reports of the incidence of this condition vary between 0.2 per 100 000 and 10 per 100 000.<sup>1,3</sup> Prompt diagnosis and management is important as delayed diagnosis is known to be associated with poorer long term outcomes.<sup>1–4</sup>

Delay in diagnosis has been associated with increased slip severity.<sup>2–4</sup> Increased slip severity has been associated with higher risk of serious complications such as avascular necrosis,<sup>1,5</sup> chondrolysis,<sup>1,3</sup> and poorer long term outcomes including pain, reduced hip mobility and secondary hip osteoarthritis.<sup>2,3</sup>

Delay in presentation of children with SUFE has been observed at The Royal Children's Hospital (RCH) in Melbourne, Victoria. This study aimed to investigate clinical history and referral



**Figure 1.** Normal hip (left) and mild SUFE (right). A line drawn along the upper border of the femoral neck bisects a segment of the epiphysis in the normal hip, but fails to cut off a segment of the epiphysis in a slip  
Image courtesy ERC, Royal Children's Hospital, Melbourne

**Table 1. SUFE – a summary****Aetiology**

SUFE is believed to be caused by mechanical and biochemical factors which lead to decreased strength and subsequent failure across the physis. Mechanical factors include obesity, increased femoral retroversion, and increased physeal obliquity; biochemical factors include the hormonal changes of puberty and endocrine dysfunction.<sup>1,7-9</sup>

**Classification**

The traditional classification of SUFE is based on the patient history, duration of symptoms, clinical examination and radiographs. Slips are classified as acute, chronic, or acute-on chronic. In acute slips, there is a sudden onset of severe symptoms and inability to weight bear. In chronic slips, there is gradual onset and progression of symptoms for more than 3 weeks, without sudden exacerbation. In acute-on chronic slips, there is sudden exacerbation of symptoms due to acute displacement of a chronically slipped epiphysis. Recent classification is based on physeal stability and the ability of the child to ambulate; slips are considered stable when the child is able to weight bear. In unstable slips the child is unable to weight bear.<sup>1,5</sup>

**Diagnosis**

The diagnosis of SUFE is often difficult because early symptoms can be mild, variable and insidious in onset. Children presenting with SUFE may complain of pain in the affected hip or groin, thigh or knee. The pain may be mild or intermittent, or so severe that the child is unable to weight bear. Examination of the hip shows decreased range of movement, particularly internal rotation (*Figure 2*). Gait abnormality is frequently observed. The child may walk with a limp and the affected leg in external rotation. Diagnosis is confirmed by antero-posterior and lateral hip radiographs which demonstrate the posterior and inferior displacement of the epiphysis relative to the metaphysis. Radiographic diagnosis from antero-posterior radiographs in mild slips can be subtle. In early slips, where the displacement is typically posterior, the slip may be seen only on lateral hip radiograph (*Figure 3a-c*).<sup>1,5,7,8</sup>

**Management**

Management is always surgical. On diagnosis of SUFE, the child should be made nonweight bearing, and urgently referred to an orthopaedic surgeon or hospital emergency department. Surgical stabilisation of the hip should take place on an urgent basis.

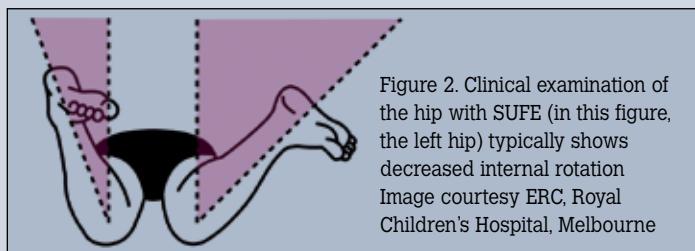


Figure 2. Clinical examination of the hip with SUFE (in this figure, the left hip) typically shows decreased internal rotation  
Image courtesy ERC, Royal Children's Hospital, Melbourne

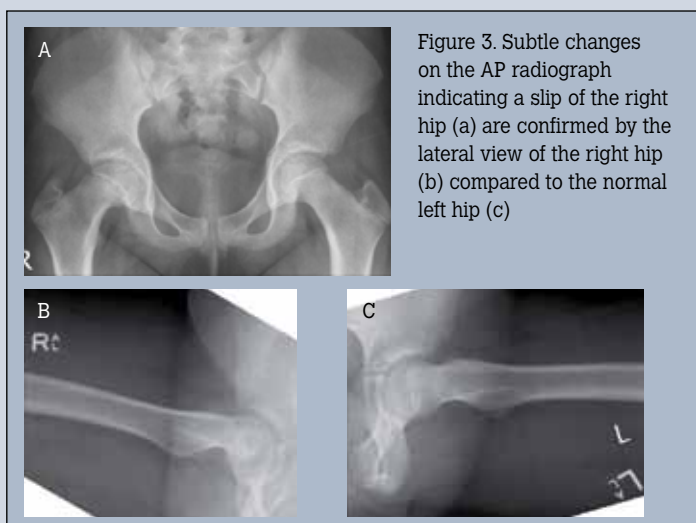


Figure 3. Subtle changes on the AP radiograph indicating a slip of the right hip (a) are confirmed by the lateral view of the right hip (b) compared to the normal left hip (c)

patterns of children presenting to the RCH with SUFE, in order to evaluate the incidence of apparent delays or missed diagnosis and to identify the stage at which these delays occurred.

**Method**

All children admitted to the RCH with SUFE between June 2003 and June 2007 were identified using the hospital's database. For children diagnosed before June 2006, a retrospective medical history review was conducted to determine age at admission, gender, residential location (metropolitan or regional) and medical insurance status. Clinical data was also collected from the child's medical record (unilateral or bilateral SUFE at admission, weight on admission, stability of SUFE based on ability to weight bear, duration of symptoms, type of health professionals consulted, investigations, time delay from onset of symptoms to first presentation and from first presentation to diagnosis and admission). Data was also confirmed by telephone conversation with the parent and/or child. Two children were excluded from the study due to poor recollection of events by the parent, and inadequate records in the medical file.

For children diagnosed after June 2006, data was collected prospectively and parents were interviewed with their child during hospital admission.

Approval to conduct this study was granted by The Royal Children's Hospital Human Research Ethics Committee.

**Results**

One hundred and twenty children with SUFE were identified for inclusion in the study. As two children were excluded, this represents 98% of the total number of children with SUFE admitted to the RCH over the study period.

There were 69 boys and 51 girls, with an average age at admission of 13 years 1 month for boys (range 8 years 8 months to 16 years), and 11 years 6 months for girls (range 9 years 8 months to 14 years 7 months). Ninety-four children resided in the metropolitan area, while 26 resided in regional Victoria. Twenty-eight children (23%) were covered by private health insurance.

Fifty-five children presented with left sided SUFE, 48 with right sided SUFE, and 17 with bilateral SUFE. One hundred and three patients

were classified as stable (86%) and 17 as unstable (14%) at admission. Many of these children were overweight with 67 children (56%) above or equal to the 90<sup>th</sup> percentile and 53 children (44%) above or equal to the 97<sup>th</sup> percentile. By contrast, there were only 13 children (11%) whose weight was represented below the 50<sup>th</sup> percentile.

Most commonly, children presented initially to their general practitioner (76%), followed by physiotherapist (10%), hospital emergency department (5%), and chiropractor (4%). The remaining children initially consulted another specialist (not an orthopaedic surgeon) or sought alternative therapy.

Of the 103 children with stable SUFE, the diagnosis was missed in 62 (60%), hip X-rays were requested in 54 (52%), and knee X-rays alone were requested in six children (6%).

The delay from initial presentation to a health professional to hospital admission ranged from 0–731 days. The delay for children with stable SUFE from the date of hip radiograph to the confirmation of diagnosis ranged from 0–11 days. For these children, the delay from diagnosis of SUFE to admission ranged from 0–65 days. There were no delays from hip radiograph to confirmation of diagnosis for children with unstable SUFE.

## Discussion

This study looks at delays to diagnosis for children with SUFE at the RCH between June 2003 and June 2007. Importantly, while the RCH sees the vast majority of relevant patients in Victoria, the findings of this study cannot be assumed to be generally applicable to the wider Victorian or Australian population as we have not collected any data on children admitted to other institutions. In addition, no statistical analysis was performed.

An important possible source of bias in this study is the use of two different data collection methods: prospective and retrospective. Data was collected both from discussions with parents at the time of admission and from phone conversations about prior admissions; the temporal relationship to the event may have influenced the data collected. Also data was collected from files retrospectively and prospectively; knowledge of the study by

hospital staff may have influenced the data collected in the prospective arm. However, as the data collected was factual and numerical, the impact of this possible source of bias is likely to be minimal.

In our study group, the GP was the most common first point of contact, with 76% of patients presenting initially to their GP. Despite the limitations described above, it is of concern that not all children in this study were appropriately investigated and urgently referred to the emergency department or orthopaedic surgeon; a significant number of those children able to weight bear faced unacceptable delays to diagnosis and admission. Delays are known to be associated with increased severity of physeal slip and poorer long term outcomes.<sup>1–5</sup>

Importantly, as children with unstable SUFE are unable to weight bear they are more likely to present to a hospital emergency department. Early diagnosis of a stable slip in the general practice setting may help avoid progression to an unstable slip, which has a poorer prognosis.

At initial consultation, the diagnosis was missed in 62 children (60%) with stable SUFE, of whom 49 had no hip X-ray. For some patients with stable SUFE, despite an X-ray being ordered, the diagnosis of SUFE was delayed for up to 11 days after the X-ray. Reasons for missed or delayed diagnosis were not collected in this study. However, the key to diagnosis of SUFE is careful clinical evaluation of the hip, even in the presence of thigh or knee pain only. Therefore, alertness to possibility of SUFE is likely to be an important factor leading to earlier diagnosis. This suggests that undergraduate medical and postgraduate GP education on the evaluation of paediatric patients with hip, thigh or knee pain may need to be improved. A child presenting with hip, thigh or knee pain and reduction of hip range of movement on the affected side, particularly internal rotation, should arouse clinical suspicion. This should prompt radiographic imaging of the hip with antero-posterior and lateral hip views.

This study highlights the crucial role of the GP in the early recognition and diagnosis of SUFE. This will ensure timely and appropriate referral and best possible outcome for the child.

While it must be recognised that SUFE may occur in even the most slender child, correlation between rising childhood obesity and an

increased incidence of SUFE has been reported.<sup>6</sup> In our study, the majority of children presenting with SUFE weighed above the 90<sup>th</sup> percentile. The impact of obesity on the musculoskeletal health of children, and its long term effect through the life continuum is a public health issue that warrants further investigation.

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