Paediatric Orthopaedics and Fractures

IN TWO VOLUMES

VOLUME 2

W. J. W. SHARRARD

SECOND EDITION

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Finally, I owe much to my family whose tolerance, help and understanding during the many months of work into the small hours have made it possible to write this book at all.

Preface to the Second Edition

Advances that have taken place in the last seven years have shown that orthopaedic surgery continues to be a progressive discipline. In almost every aspect of paediatric orthopaedics, new findings, advances in technique and better results of treatment have been discovered. In preparing the first edition, one of my aims was to ensure that the text was as up to date as possible; in this edition I have tried to maintain this standard. Every chapter has been progressively revised in the light of current publication and my own continuing experience.

Some sections, particularly those in which considerable changes have taken place, as in the surgery of the spine, have been recast, and, it is hoped, improved. Other parts have needed less drastic change, but few have remained static.

There are those who say that further editions of a book should not be larger than their predecessors. No apology is offered for the fact that this edition is larger and more profusely illustrated than before. Those who use the text as a reference wish for more completeness, for example, in the cataloguing and illustration of abnormalities, diseases and syndromes. Those who use it for practical surgery have asked for additional content of operative techniques. I have tried, at least in part, to meet both requirements. Wherever time or trial has shown that methods of management or operative procedures are no longer useful they have been eliminated except for historical mention.

W.J.W.SHARRARD

Preface to the First Edition

The last 20 years have shown a remarkable advance in orthopaedic surgery in children. Better understanding and knowledge of intra-uterine development, of the genetics of orthopaedic conditions, of the causation, diagnosis and treatment of congenital dislocation of the hip, talipes equinovarus, scoliosis, poliomyelitis, cerebral palsy, spina bifida, osteomyelitis and tuberculosis has made much that was previously written in orthopaedic textbooks outdated. The trend of orthopaedic treatment has moved away from management by manipulation and splintage to the rational use of surgery, aided by improved surgical and anaesthetic techniques and by the better protection afforded by antibiotic drugs.

The realization that some conditions normally correct themselves with growth and are not, strictly speaking, true deformities but variations of normal development has meant that some of the measures previously employed in treatment can be discarded.

From my own experience and from the writings of others, I have tried to put together all that is currently useful in the treatment of orthopaedic conditions in childhood. The aim of this book is to help the practising orthopaedic surgeon and orthopaedic surgical trainee, but I hope that it will be read and used for reference by any who practise in the field of paediatric work.

If there is a theme that is common to almost all orthopaedic conditions in childhood, it is concerned with the effects of growth and development. It is this that separates the measures that are used in childhood from those in adults and it is the main reason why it is appropriate that there should be an orthopaedic textbook devoted entirely to paediatric conditions.

I have tried to balance the content fairly between all aspects of work as they come to the orthopaedic surgeon. Some diseases, such as tuberculosis and poliomyelitis, no longer form a large part of orthopaedic surgery in Europe and North America but substantial portions of the text deal with these subjects because of their continuing prevalence in many parts of the world. In some fields, such as cerebral palsy and spina bifida, there is need for the use of sophisticated techniques and multidisciplinary management that may, as yet, only be applicable in centres in which all facets of medical and surgical expertise are available. The complex conditions of today are the commonplace conditions of tomorrow and there are few hospitals where it is not possible to gather together a team of individuals capable of treating major abnormalities by combined action. For those who thirst for additional and more detailed information, each chapter is provided with a list of references that seem to the author to be authoritative or useful.

W.J.W.SHARRARD

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Chapter 10
Abnormalities of the Epiphyses

EPIPHYSIAL OSTEOCHONDRITIDES

The development of the clinical use of radiology led to the recognition of a number of disease processes affecting the epiphyses in childhood which came to be loosely classified under the general heading of osteochondritides. Buchman (1929) defined osteochondritis as a non-inflammatory, non-infectious derangement of the normal process of bony growth occurring at the various ossification centres at the time of their greatest developmental activity. Although some radiological abnormalities of epiphyses are now known to be variants of normal development and others are the direct result of trauma, there remain a number of specific lesions, of which osteochondritis of the hip is the most important, whose precise etiology is still not known but which almost certainly represent the effects of vascular disturbance to all or part of an epiphysis or a bony nucleus.

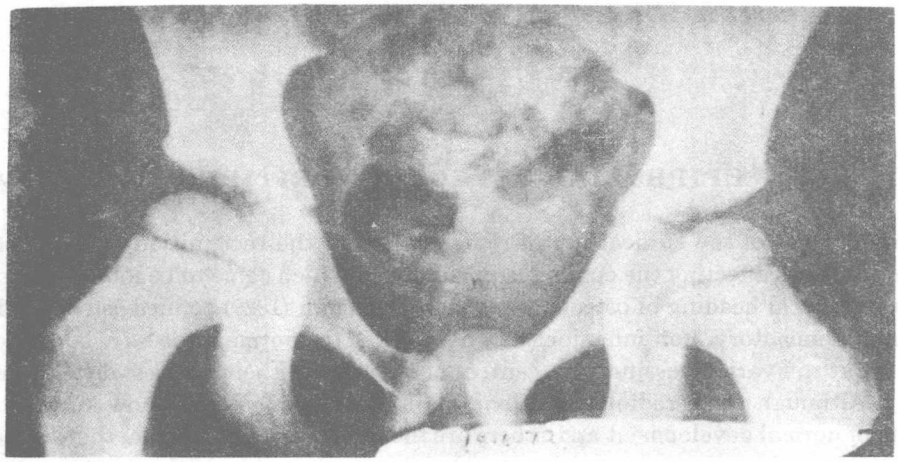
Most of them have come to be known by the name of the original observer. Although there are sometimes objections to the use of eponymous descriptions they have the value of brevity. For instance, Perthes' disease would otherwise have to be written as idiopathic ischaemic necrosis of the upper femoral epiphysis. Other conditions designated by an eponym include Osgood–Schlatter's disease (tibial tubercle), Köhler's disease (tarsal navicular), Freiberg's disease (second metatarsal head), Scheuermann's disease (vertebral bodies), Panner's disease (capitulum), Sever's disease (calcaneum) and Johansson–Larsen syndrome (patella).

OSTEOCHONDRITIS OF THE UPPER FEMORAL EPIPHYSIS (LEGG–CALVÉ–PERTHES' DISEASE)

Osteochondritis of the hip is a condition arising in childhood from disturbance of the upper femoral epiphysis secondary to ischaemic necrosis. The precise precipitating cause of the ischaemia has not yet been established. The condition was described separately in the United States, Germany and France by Legg (1910), Perthes (1910) and Calvé (1910). It has also been called coxa plana (Waldenström 1920) and pseudocoxalgia because it had previously been confused with tuberculosis of the hip.

It occurs in children, with an onset between the ages of 4 and 9 but it can occur as early as 2 years and as late as 18 years. It is four times as common in boys as in girls and is

bilateral in about 15 per cent. Bilateral lesions tend to occur in younger children and girls developing the disease tend to be younger than boys (Fisher 1972). Wansbrough *et al.* (1959) and Inglis (1960) report the condition in each of identical twins but Wynne-Davies & Gormley (1978) found no obvious pattern of genetic inheritance. They found that the disease occured particularly in children who were third-born or late in the family, were from low-income families or had shown mal-position *in utero*. The frequency of bilateral



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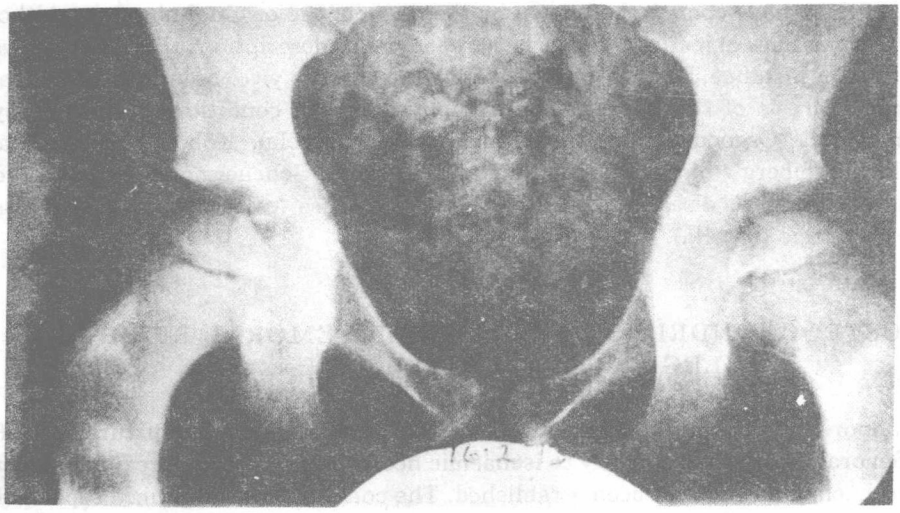
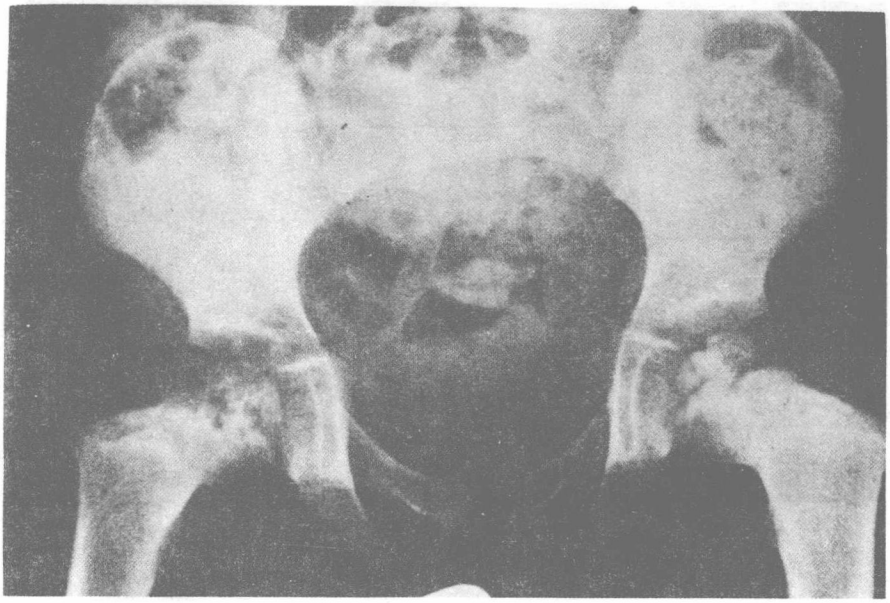


(b)

FIG. 10.1. Early radiological changes in Perthes' disease. (a) Clinical signs of an irritable left hip. The radiographic appearances are normal. (b) Eight months later, there are radiographic signs of early Perthes' disease with widening of the joint space, slight increase in density of the capital epiphysis and slight metaphysial changes.



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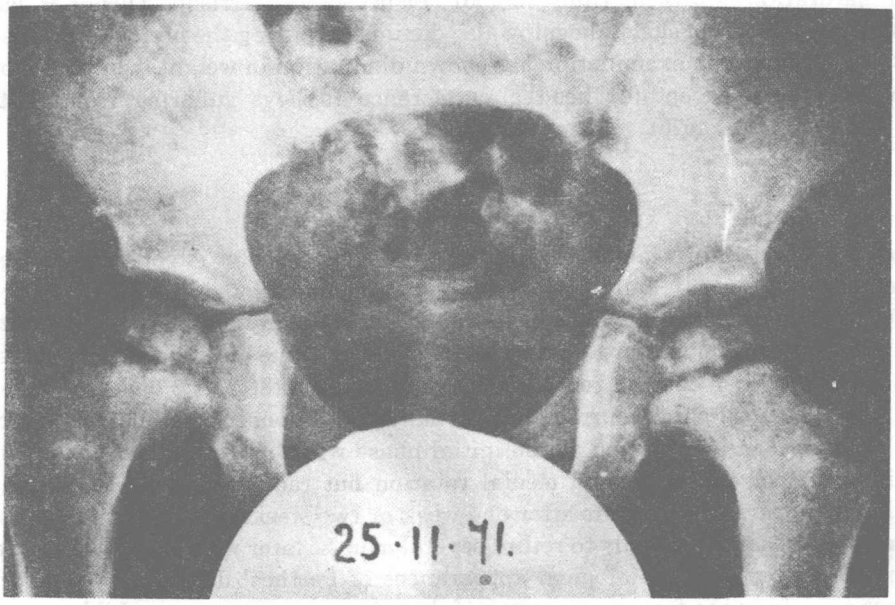
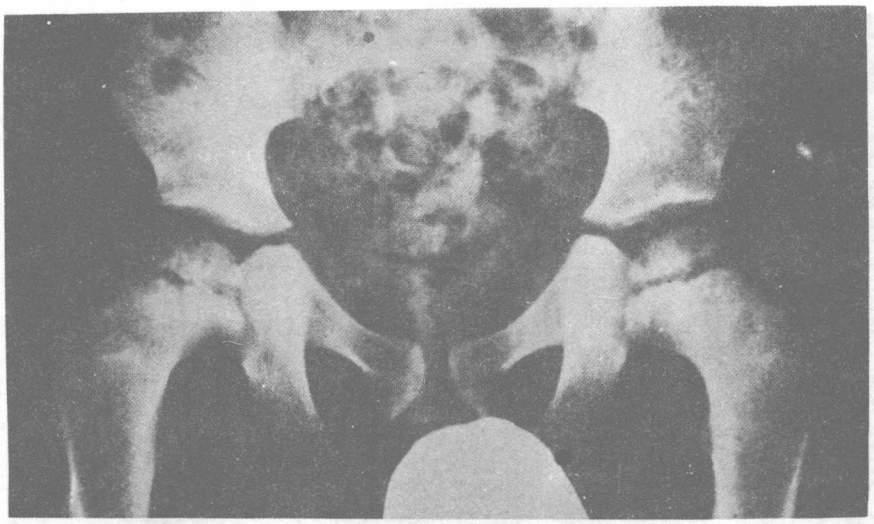


(b)

FIG. 10.2. Radiographs of symptomless Perthes' disease. (a) At time of coincidental radiograph during investigations for abdominal symptoms. There are considerable changes in the metaphysial and capital epiphysial regions of both hips. (b) Three months later. No treatment has been given. Repair is occurring rapidly.



(c)

FIG. 10.2. (c) Six months later there is almost complete recovery.

involvement also suggests a constitutional abnormality. A consistent retardation of skeletal maturation is present (Ralston 1961; Fisher 1972; Harrison, Turner & Jacobs 1976), and the velocity of skeletal ageing also diminishes during the period of the disease process. Anthropometric examination has shown diminution in weight, height and other body measurements except for head circumference in boys suffering from Perthes' disease (Burwell *et al.* 1976).

CLINICAL FEATURES

The mode of onset and the initial symptoms vary considerably. A constant and early symptom is a limp usually, but not invariably, accompanied by pain which may be felt in the front of the thigh, in the knee or in the groin. The symptoms may be intermittent at first. It is not uncommon for a history to be given that the child had limped between 3 and 6 months earlier but had recovered spontaneously after 2 or 3 days and resumed normal activities until pain recurred and was more continuous. Sometimes, such a child may be referred for investigation at the initial phase when movements of the hip show slight limitation of abduction and medial rotation but radiographs are normal. (Fig. 10.1). The hip apparently recovers after one week or two weeks and the child is allowed to resume normal activities, only to return several months later with an acute recurrence of symptoms and typical radiological appearances of Perthes' disease. Two important inferences arise from the features of a case of this kind. One is that any child presenting for the first time with radiological signs of established Perthes' disease, even though it may be in the so-called first stage radiologically, has already been suffering from the condition for at least 2 or 3 months. The second is that any child who complains of pain or has a limp should be kept under observation even if his symptoms recover and radio-

graphs are normal, and should have further radiographs taken 6 to 8 weeks later to determine whether the initial radiological signs of Perthes' disease are present. Sometimes the child or parent may not make complaint of a limp but only of slight abnormality of gait such as a tendency to walk with the leg turned inwards. Florid radiological changes have been found in the hip in patients during investigations for unconnected conditions or in a sibling in a family thought to be liable to Perthes' disease without there having been any symptoms at all (Fig. 10.2). Perthes' disease can occur in two discrete episodes separated by weeks, months or even years. It is not rare for acute involvement of the opposite hip to develop whilst the first hip is still under treatment. Involvement of the same hip on two separate occasions has been recorded rarely (Kemp, Cholmeley & Baijens 1971; Katz 1973).

The signs are also very variable. In a typical case, there is some limitation of all movements of the hip but particularly of abduction, medial rotation, flexion and extension. There may be some fixed flexion. In others, there is no clinical limitation of movement in any direction. Limitation of movement is usually accompanied by muscle spasm which is most evident in the adductor and psoas muscles. There may be wasting of the thigh and buttock. The hip may be palpably thickened and tender, though it is not always easy to determine whether a hip is tender in a child of 3 or 4 years. In patients presenting late, in whom the disease has partially run its course, there may be no clinical findings except for slight loss of full range of abduction, extension and medial rotation.

Biochemical investigations are negative except for the erythrocyte sedimentation rate which may be slightly raised.

RADIOLOGICAL APPEARANCES

A great variety of radiological changes may be seen in Perthes' disease, depending on the extent of involvement of the upper femoral epiphysis, the severity of the lesion, the age and sex of the child and the length of time since the onset of the condition. In general, there is a sequence of changes common to all types of lesion.

First stage

Strictly speaking, there are no radiological changes immediately after the onset (Fig. 10.1) and for up to 4 weeks, the only abnormal finding may be slight lateral displacement of the femoral head. Swelling and thickening of the capsular shadow which has been described as a feature of early Perthes' disease is a radiological artefact resulting from a laterally rotated position of the hip in an anteroposterior radiograph (Brown 1975). At this time, the findings are not diagnostic of Perthes' disease but are the same as may been seen in some cases of transient synovitis. The first changes indicative of epiphysial damage are a widening of the joint space, some of which is due to cessation of growth of the bony epiphysial nucleus and some to swelling of the tissues in the acetabular fossa, slight porosis of the metaphysial region of the femoral neck adjacent to the epiphysial line, slight flattening of the bony nucleus and some alteration in the texture of the nucleus (Fig. 10.3). Sometimes a subchondral fracture may be visible in the upper and lateral part of the head (Fig. 10.4).

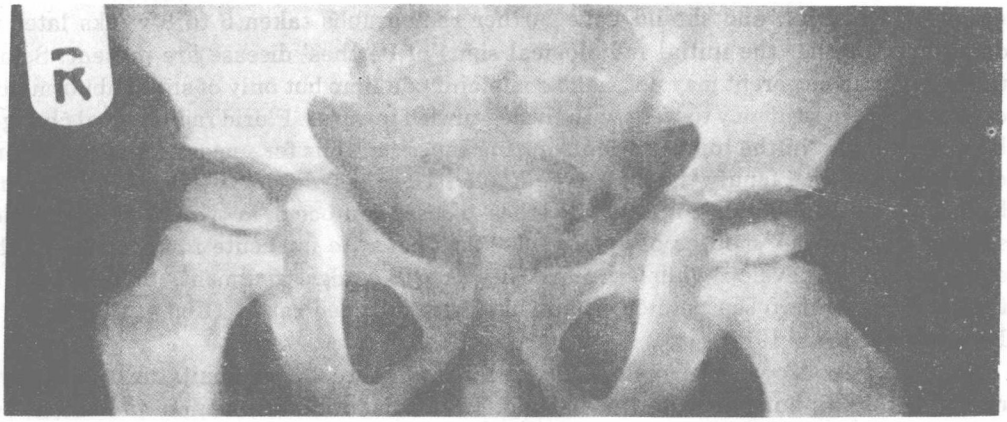


FIG. 10.3. Radiograph of first stage of Perthes' disease of the left hip. There is slight widening of the joint space and porosis of the metaphysis immediately adjoining the epiphysial line. There is some flattening of the epiphysial nucleus.

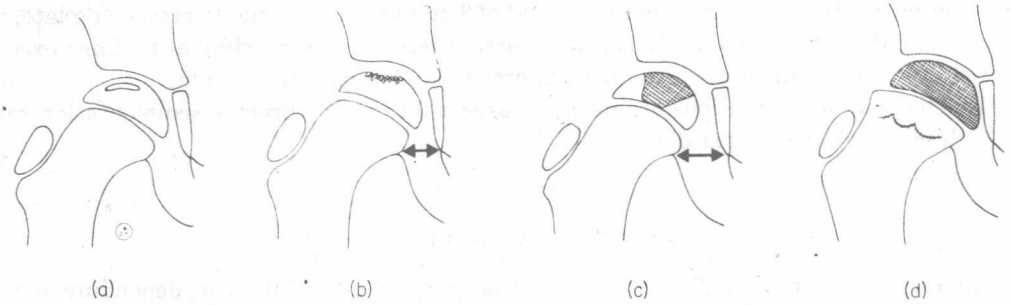


FIG. 10.4. Early radiological signs in Perthes' disease.

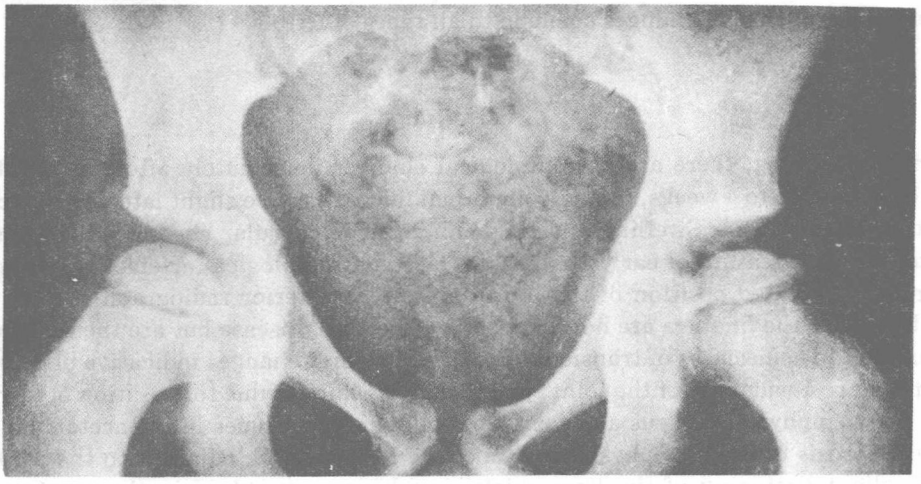
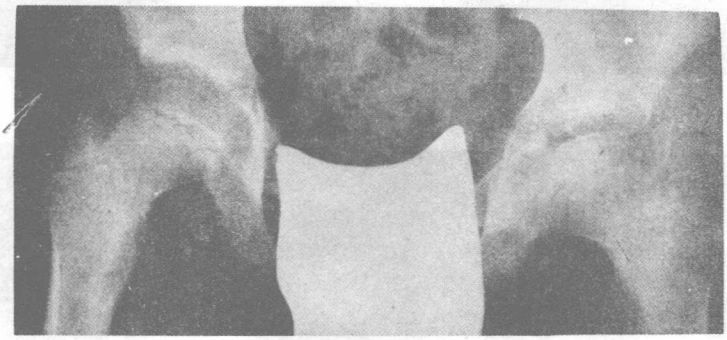


FIG. 10.5. Radiograph of second stage of Perthes' disease of the right hip. There is an overall increase in density of the femoral head.

Second stage

It is at this time that the patient is often seen for the first time. In addition to the first stage changes, there develops an increase in density of the femoral head (Fig. 10.5) affecting either the whole head or some portion of it (Fig. 10.6a & b). The extent of involvement can only be properly appreciated if both anteroposterior and lateral Lauerstein views (Fig. 10.6) are taken. The prognostic significance of the extent of involvement of the femoral head will be considered below. The changes in the adjoining metaphysis are more obvious and correspond with the extent of the epiphysial changes, but vary in



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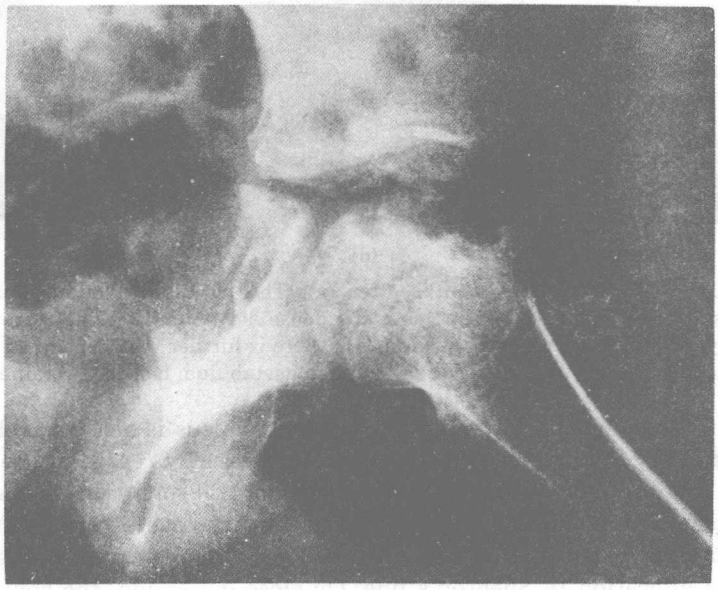
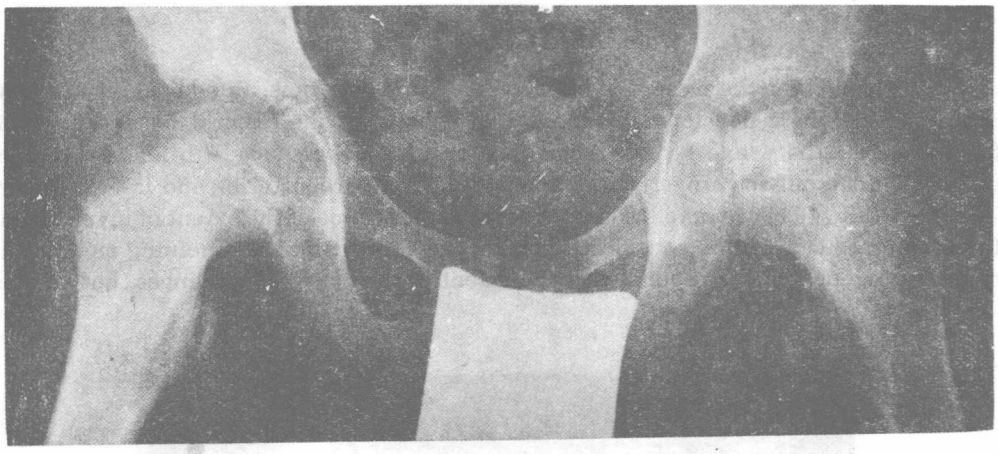


(b)

FIG. 10.6. Radiographs of Perthes' disease (Catterall group II) of the left hip affecting the anterior half of the epiphysial nucleus. (a) Second stage anteroposterior view. (b) Second stage lateral view.



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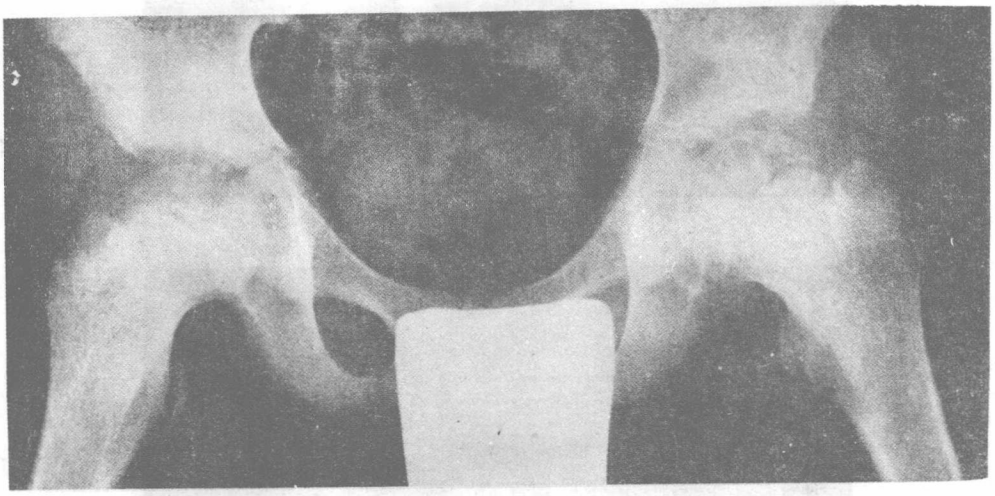
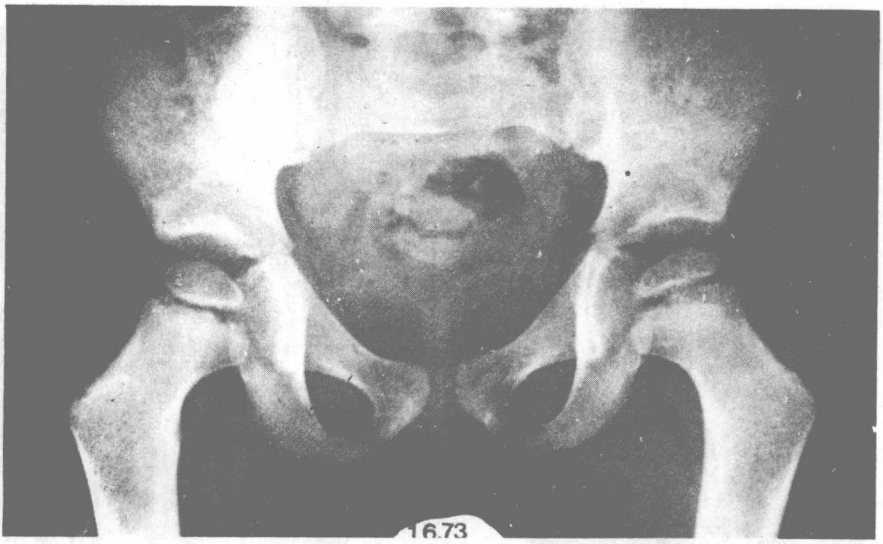


(d)

FIG. 10.6. (c) Third stage 3 months after (a). The fragmented outer half of the epiphysis is being replaced by new bone and dense dead bone is being removed progressively. (d) Third stage 9 months after (a). There is further replacement of necrotic bone. The normal shape of the femoral head and acetabulum has been retained.

their degree. The amount of flattening of the bony nucleus is also variable (Figs 10.5, 10.7a, 10.8a & 10.9b) at this stage but it does not necessarily represent the shape of the femoral head. Arthrography (Gershuni, Axer & Hendel 1978) often shows that the femoral head is of good shape and, even without arthrography, the overall shape of the head can be inferred from the wideness of the space between the nucleus and the acetabulum and the absence of alteration in Shenton's line. On close inspection, the bony nucleus can often be seen to consist of a central portion comprising the small avascular original epiphysial nucleus surrounded by new bone, the appearance of a 'head within a head' (Salter 1966).



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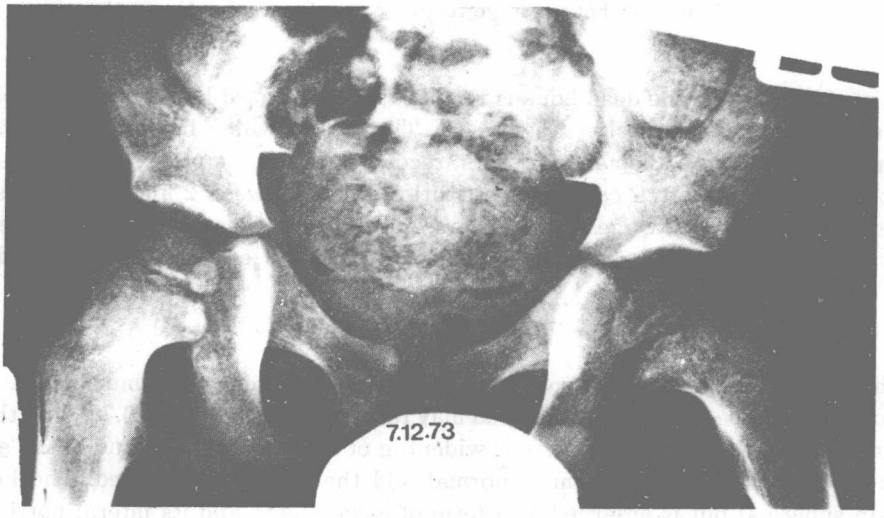

(b)

FIG. 10.7. Radiological changes of mild Perthes' disease (Catterall group I) of the left hip in a child aged 5 years. (a) Second stage changes with slight flattening of the upper femoral epiphysis and minimal metaphysial changes. (b) Third stage healing after 6 months.

Third stage

Radiolucent areas appear in the epiphysis associated with the removal of the dead bone (Fig. 10.6c). The nucleus of the epiphysis appears to break up into a number of fragments with cyst-like spaces between. At the same time, new bone starts to develop at the medial and lateral edges of the epiphysis which may become widened and the metaphysial