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Approach to foot deformities in a child

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Learning objectives

- Understand the common foot deformities seen in paediatric patients.
- Identify the clinical features and examination findings associated with various foot deformities.
- Discuss the importance of early detection and management of foot deformities to prevent long-term complications.
- Familiarisation with non-surgical and surgical treatment options for paediatric foot deformities.
- Recognise the role of orthopaedic surgeons in the management of complex foot deformities in children.

Introduction

Foot deformities in children are common and can range from mild conditions to more complex abnormalities. As primary care providers, it is essential to recognise these deformities early and initiate appropriate management. This chapter aims to provide insights into the clinical presentation, diagnostic approach and treatment options for paediatric foot deformities. Some of the most common foot deformities include congenital clubfoot, pes planus (flatfoot) and pes cavus.

Pes planus (flatfoot)

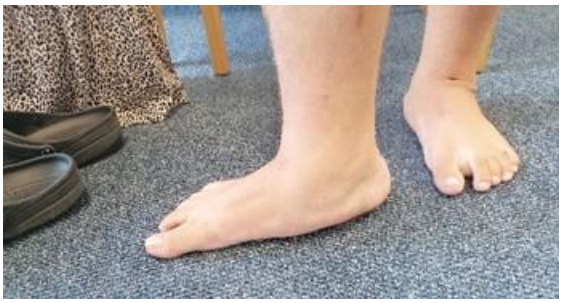

***Figure 1**: Patient with pes planus (flatfoot). The absence of the arch can be noted.*

Clinical findings

History

Parents or caregivers may notice a flattening of the child's arch, especially when standing. It is nearly universal in children less than 2 years and typically resolves spontaneously between the ages of 2 and 3, when the ligaments and tendons in the foot and leg strengthen. Although it's rarely pathological, childhood flexible flatfoot might persist into adulthood and seldom requires intervention.

Examination

Look for a loss of the medial arch when the child stands. When examining the foot from the back, the heel is in valgus and the "too-many-toes" sign may be present.

Assess flexibility: The arch may reappear when the child rises on their toes (supple flatfoot), but it remains absent in stiff flatfoot.

Observe the child's gait: Flatfoot can lead to an inward rolling of the foot (pronation) during walking.

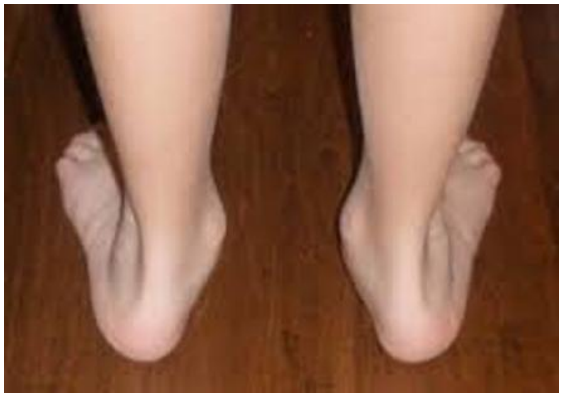

Figure 2: *Flatfoot with the "too-many-toes" sign. Usually only the 4th and 5th toes are seen but, in this sign, more may be seen.*

Special investigations

Imaging

X-rays are usually not required for diagnosis. In severe cases or when other conditions are suspected, referral for further imaging or specialist evaluation may be warranted.

Management

Non-surgical

- Most cases of paediatric flatfoot do not require surgery and can be managed conservatively.
- Physiotherapy and exercises to strengthen the foot and ankle muscles may alleviate pain and fatigue associated with flatfoot.
- Supportive footwear and orthotic inserts are the first line of treatment for symptomatic flatfoot.
- Nonsteroidal anti-inflammatory drugs (NSAIDs) can relieve pain.
- Surgery is rarely indicated and reserved for symptomatic flatfeet that do not respond to conservative measures.

Causes of a stiff or rigid flatfoot

- Tarsal coalitions.
- Neurological flatfeet (for example, in cases of cerebral palsy).
- Inflammatory conditions (for example, in cases of rheumatoid arthritis and juvenile idiopathic arthritis [JIA]).

Congenital clubfoot

Figure 3: *Inward turning of the feet in clubfoot (Source: Richard Masoner, CC BY-SA)*

Clinical findings

History

Parents and caregivers may notice a significant inward turning of the foot and restricted movement. Clubfoot is a birth defect (a congenital abnormality) where a child's foot points inward instead of forward. The condition is normally identified after birth.

Examination

- Observe the foot position: The foot is turned inwards and downwards (equinovarus deformity).
- Note muscle tightness and tendon contractures around the ankle and foot.
- Evaluate the range of motion in the affected foot and compare it to the other side.

Special investigations

- X-rays are not required for diagnosis as it is a clinical diagnosis. They are performed if the foot does not respond to serial casting.
- Antenatal ultrasound can diagnose congenital clubfoot.

Management

Early intervention is crucial for optimal outcomes.

Non-surgical

Non-surgical treatment involves Ponseti casting and stretching to gradually correct the foot position. This should be initiated as soon after birth as possible, within the first few days of life. The Ponseti method involves gentle stretching and serial casting according to a well-defined protocol. The cast should be changed weekly until the clubfoot is corrected. This is usually followed by an Achilles tendon tenotomy and a strict bracing protocol until the age of 4 years.

Surgical

In severe cases, or when the clubfoot doesn't respond to non-surgical methods, surgery may be indicated. Surgery involves releasing contracted ligaments and joints to correct the position of the foot. Surgery is associated with stiffness and pain in early adulthood. The child will have to wear a brace for up to a year after the surgery to keep the foot in the correct position.

A more in-depth explanation of clubfoot is available in the "Clubfoot" chapter.

Accessory navicular bone

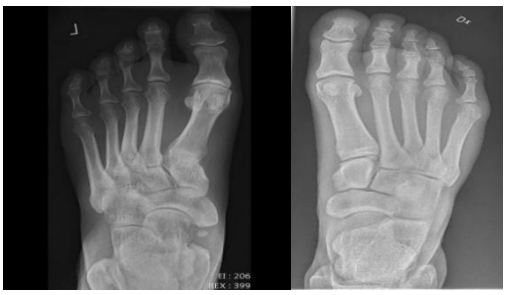

Figure 4: *Dorsoplantar x-ray of the foot. Left image shows an accessory navicular bone on the left foot medial side (Source: Jakob Steenberg, CC BY-SA). Right image shows a normal right foot (Source: Mikael Häggström, CC0).*

Clinical findings

History

Children may present with pain and tenderness on the inner side of the foot, exacerbated by shoewear. An accessory navicular bone is an accessory ossicle adjacent to the medial side of the navicular bone. The accessory navicular bone can be seen as an enlargement of the navicular or as a sesamoid within the posterior tibial tendon.

Examination

- Patients will typically present with a flatfoot and pain over the medial side of the foot.
- Palpate the medial side of the foot to identify an accessory navicular bone.
- Assess for localised tenderness and swelling.

Special investigations

X-rays can confirm the presence of the accessory navicular bone.

Management

Non-surgical

- Most cases can be managed conservatively with rest, ice, compression and elevation (RICE).

- Orthotic inserts and supportive footwear can help alleviate symptoms.

Surgical

Rarely, surgical removal of the accessory navicular bone may be considered for persistent symptoms.

Pes cavus

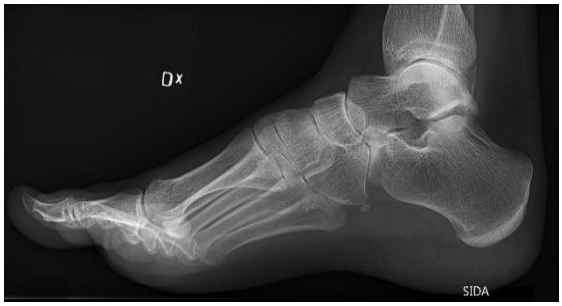

Figure 5: *Lateral x-ray of the foot, showing a high arch in pes cavus (Source: Mikael Häggström, CC0)*

Clinical findings

History

Parents or caregivers may notice an exaggerated arch of the child's foot. Due to abnormal load bearing, the child may develop painful callosities under the metatarsal heads and under the lateral border of the foot. Frequent ankle sprains are also a common complaint.

Pes cavus, or more specifically pes cavovarus, is nearly always associated with an underlying neurological condition, specifically peripheral neuropathies such as Charcot-Marie-Tooth disease. A thorough neurological history needs to be obtained.

Examination

- Look for an abnormally high medial arch when the child stands.
- **Assess flexibility:** Arch typically remains high and rigid, even when the child rises on their toes.
- **Observe the child's gait:** Pes cavus can lead to an outward rolling of the foot (supination) during walking.
- Perform a thorough neurological examination looking for wasting of muscles, abnormal reflexes and sensation.

Special investigations

X-rays are typically performed to exclude underlying abnormalities and to quantify the severity of the deformity.

All cases of paediatric pes cavus should be referred to an orthopaedic surgeon for further evaluation, as it is seldom physiological.

Management

Non-surgical

Mild cavus deformity can be managed with supportive footwear and orthotics to distribute weight more evenly and improve pain and instability.

Surgical

Most cases of pes cavus in children will progress and eventually require surgery. For milder deformities, tendon releases and transfers are indicated. More severe deformities require osteotomies and sometimes fusions.

Curly toe (clinodactyly)

Clinical findings

History

Curly toe is a common deformity which is usually bilateral and may be hereditary. It is characterised by flexion and medial deviation of the toe. The adjacent toe may be overriding and is most commonly seen in the 3rd and 4th toes. Later in life, they may cause pressure symptoms and present with calluses, blisters or nail deformities.

Examination

- Look for a proximal interphalangeal (PIP) joint that rests in a flexed position, with or without a flexion deformity of the distal interphalangeal (DIP) joint.
- Fully and passively extend the PIP and DIP joints while the metatarsal

phalangeal (MTP) joint is held flexed to confirm the absence of capsular contractures.

- You might also find a varus posture of the toe with lateral rotation that leads to underriding of the adjacent toe.

Special investigations

Imaging studies such as x-rays and radiographs are not usually necessary in the evaluation and management of curly toe.

Management

Non-surgical

In some cases, the deformity will resolve spontaneously. Taping the curly toe to an adjacent toe in the first few months of life may improve the deformity. Surgery before the age of 6 is not recommended.

Surgical

- Surgery is indicated if the curly toe leads to pain, callosities or difficulty with shoewear.
- **Simple tenotomy:** A surgeon will make a small incision near the affected tendon and carefully sever or cut the tendon. This intentional cutting of the tendon releases its tension, allowing for greater flexibility and improved range of motion.
- **Transfer of the long flexor to the extensor apparatus:** A surgeon will move a tendon from the group of muscles responsible for flexing a toe to a position where it assists in extending the toe. This procedure aims to rebalance the forces acting on the toe.

Key takeaways

- **Paediatric foot deformities are common:** It is important to be able to distinguish normal variants from pathological conditions.
- **Paediatric flatfoot is the most common foot deformity**: It is considered a normal variant, rarely requiring treatment.
- **Early identification for optimal outcomes:** Recognising pathological foot deformities such as clubfoot or pes cavus promptly and initiating appropriate management is crucial for preventing long-term complications.
- **Clinical expertise and diagnostic proficiency:** The ability to identify clinical features and perform comprehensive examinations aids in diagnosing foot deformities. Mastery of these skills enhances accurate assessment and targeted interventions.

Assessment

1. A 10-day-old child presents with an inward turning and downward positioning of the foot. Physical examination reveals muscle tightness and contractures. Which of the following is the most appropriate initial management for this congenital foot deformity?

A. Surgical correction of the foot position

B. Application of rigid orthotic devices

C. Serial manipulation and casting using the Ponseti method

D. Observation without intervention

The answer is (C). The described foot deformity is consistent with congenital clubfoot and the most appropriate initial management is the Ponseti method, which involves serial manipulation and casting to gradually correct the foot position.

2. A 14-year-old child complains of persistent pain and tenderness on the inner side of the foot during physical activities. On examination, an accessory navicular bone is palpable and there is localised tenderness. What is the most appropriate management for this child's condition?

A. Immediate surgical removal of the accessory navicular bone

B. Supportive footwear and rest

C. Physiotherapy and stretching exercises

D. Serial casting using the Ponseti method

The answer is (B). Initial management of symptomatic accessory navicular bone involves conservative measures such as supportive footwear and rest.

3. A 6-year-old child presents with a noticeable flattening of the arch on both feet and the arch does not reappear when the child rises on their toes. Which of the following is the most appropriate initial management for this child?

A. Immediate surgical correction of the flatfoot

B. Prescribe orthotic inserts and observe for improvement

C. Referral for physiotherapy and exercises

D. X-rays to assess for underlying bone abnormalities

The answer is (D). The child presents with stiff flatfoot. This condition is always pathological and x-rays need to be assessed for underlying bone abnormalities.

4. A 9-year-old child presents with a bilateral flexion and medial deviation of the 3rd and 4th toes. The adjacent toe appears to be overriding. What is the term for this deformity?

A. Pes planus (flatfoot)

B. Pes cavus

C. Curly toe (clinodactyly)

D. Congenital clubfoot

The answer is (C). The described deformity of flexion and medial deviation of the 3rd and 4th toes, with the adjacent toe overriding, is known as curly toe or clinodactyly.

5. A 6-year-old child's parents notice a flattening of the child's arch when standing, but the arch reappears when the child rises on their toes. What type of flatfoot does this description indicate?

A. Supple flatfoot

B. Rigid flatfoot

C. Congenital flatfoot

D. Pathological flatfoot

The answer is (A). The description of a flattening of the arch when standing but reappearing when rising on toes indicates supple flatfoot. This type of flatfoot is more flexible and typically does not require surgical intervention.

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ABOUT THE BOOK

This is the second volume of the *Orthopaedics for Primary Health Care* textbook edited by Michael Held, first published in 2021.

Most patients with orthopaedic pathology in low- and middle-income countries are tested by non-specialists. This book was based on a Delphi consensus study* with experts from Africa, Europe and North America to identify topics, skills and cases concerning orthopaedic trauma and infection that need to be prioritised in order to provide guidance to these health care workers.

The aim of this book is to be student-centred.

*Held et al. Topics, Skills, and Cases for an Undergraduate Musculoskeletal Curriculum in Southern Africa: A Consensus from Local and International Experts. JBJS. 2020 Feb 5;102(3):elO.

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The information in this book is meant to supplement, not replace, orthopaedic primary care training.

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