CME Article

Hip to heel approach in the growing years

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Muscle and bone problems in children and teenagers are common. As general practitioners are often the first to be consulted, it is important that they have the required knowledge in the basic examination of the patient in order to arrive at a probable diagnosis before they refer to a specialist. In this article, we intend to provide guidance to conduct the examination in an orderly, comprehensive sequence, paying particular attention to clinical problems such as in-toeing, leg-length discrepancy, and common hip and foot conditions in children.

HISTORY

Complaints

Start by recording the complaints. The child's complaints usually fall into the following categories: pain, deformities, limp, general weakness or numbness in a certain area, and stiffness. In all cases, it is important that the clinician should take the patient's age into consideration.

Developmental history

Include the birth history, with details concerning the pregnancy, delivery, perinatal course and developmental milestones, such as when the child first sat independently, pulled to a standing position, cruised, walked independently, and developed the ability to grip. In children with conditions such as cerebral palsy or other muscle disorders, walking is always delayed, and may be important in establishing whether or not the condition is progressive[1].

Family history

Include the siblings, parents, grandparents, and any other relatives who had a similar problem or any major illness. The past history is essential, not only for understanding the background and general health of the child but also for gaining insight into the current problem.

GENERAL EXAMINATION

Examine the whole child to avoid missing important clues in diagnosis, and observe the **general body configuration**. Next, observe the **spontaneous movement patterns** for evidence of paralysis or pseudoparalysis. Joint mobility is greatest in infancy and gradually declines throughout life. The knowledge of the degree of **generalised joint laxity** (Fig. 1) is valuable in assessing a flatfoot or a dysplastic hip[2]. In general, excessive joint laxity suggests the possibility of other problems.

Primitive reflexes, including the Moro, grasp, neck-righting, symmetric tonic neck, and asymmetric tonic neck reflexes, persisting beyond six to ten months of age, may be an early sign of a neuromuscular disorder[3].

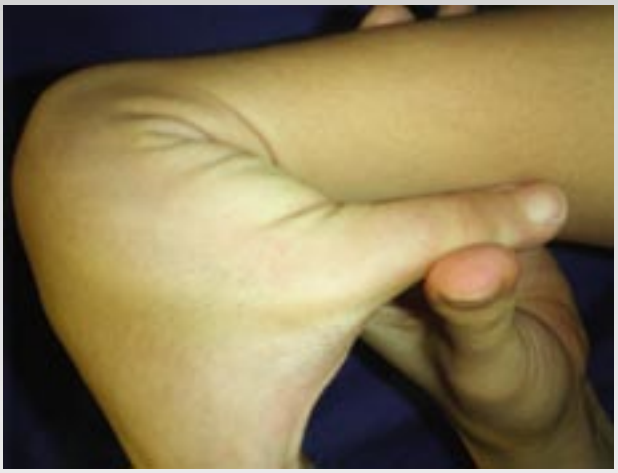

Fig. 1 Ligament laxity of the thumb.

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SPINE

The spine is an important component of lower limb examination and the physical examination begins with the patient standing, with the clinician looking for any asymmetry. The **skin** is observed for any pigmented spots, hairy patches and deep pits that might overlie external openings of sinus tracts extending to the spinal cord. The presence of café-au-lait spots (Fig. 2) or freckling in the axilla may indicate neurofibromatosis[5].

If there is a limb-length discrepancy with a compensatory lumbar scoliosis, the waist may be more accentuated on the concave side, which the patient often interprets as the "hip sticking out". Such **postural scoliosis** will be corrected when the limb-length discrepancy is corrected. Neurological examination should be part of spine examination.

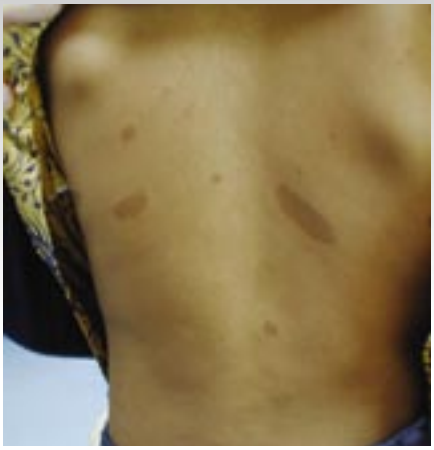

Fig. 2 Café-au-lait spots on the patient's back.

Fig. 3 Excessive internal rotation of femurs predisposed the child to sit in W-posture.

GAIT

Observation of the child's gait precedes examination of the lower limbs. Commonly encountered types of gait are antalgic, equinus (tip-toeing) and Trendelenburg's gait. In **antalgic gait**, pain with weight-bearing causes shortening of the stance phase on the affected side. In **equinus gait**, the toe strike replaces heel strike at the beginning of the stance phase. In **Trendelenburg's gait**, the weakness of hip abductors causes the shoulders to sway to the opposite side.

In-toeing and **out-toeing** gait are common complaints. The foot-progression angle measures the degree of in-toeing or out-toeing compared with an imaginary straight line drawn on the floor, normal being 15 degrees external rotation. The most common benign causes of in-toeing are metatarsus adductus, increased or persistent internal tibial torsion, and increased or persistent femoral anteversion[12] (Fig. 3).

The patient lies prone on the examining table, as described by Staheli[13]. The **internal and external rotation of the hip** measures the femoral version or torsional deformity of the femur. Assess the both sides at the same time. Internal rotation is normally less than 60º. Internal femoral torsion is mild if the internal hip rotation is 70º – 80º, moderate if 80º – 90º, and severe if >90º.

Femoral retroversion is more common in slipped femoral epiphysis. In this condition, external rotation of hip is more than internal rotation of the hip. The **thigh-foot angle** is the angle between the axis of the thigh and the axis of the foot with the knee bent to 90°. This angle measures the torsional deformity of the tibia[14]. The foot examination records the amount of metatarsus adductus or any other foot deformity that may be contributing to the in-toeing or out-toeing.

LEG-LENGTH INEQUALITY

Difference in leg length is a commonly encountered disorder in children that may be present at birth or acquired. This in fact is due to a true structural difference between the two lower limbs. In apparent limb length discrepancy, joint position or degree of tightness decreases the functional length of the affected limb. Discrepancies of 1 cm or more are considered significant[1] (Fig. 4).

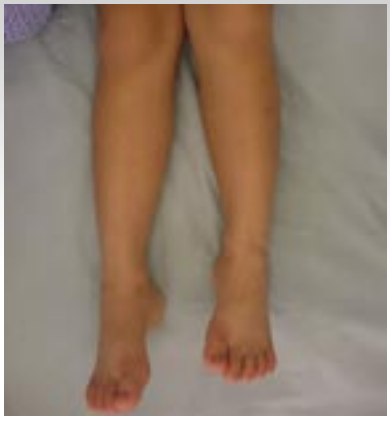

Fig. 4 Leg-length discrepancy. The left leg is shorter than the right.

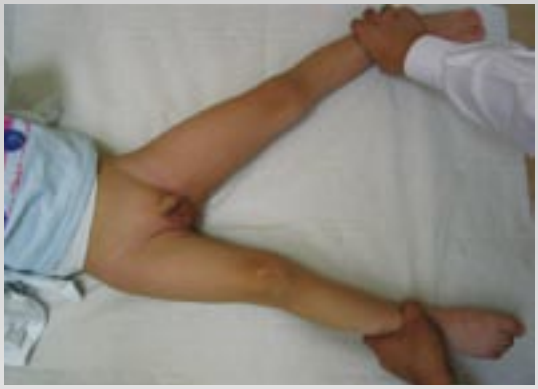

Fig. 5 Limitation of abduction in DDH.

Fig. 6 Shortened right femur compared to the normal side.

HIPS

One of the common presentations of diseases of hips in children is knee pain. Examination of the hip joint starts with observing any reduction in the movement of the affected limb. **Pseudoparalysis** is common in trauma and infections. In case of septic arthritis of the hip, the affected hip is positioned in slight flexion and external rotation to reduce intra-articular pressure. Palpate for tenderness over the jointline and the bony prominences. Tenderness of the joint line always presents in cases of inflammatory disorders of the hip. Feel for the femoral pulsation which is normally felt because of intact femoral head. In case of a dislocated or destroyed head, the femoral pulsation will be absent.

Developmental dysplasia of the hip (DDH) is diagnosed by eliciting Ortolani's[6] or Barlow's sign[7]. While examining the hip for DDH, the neck and the feet should also be checked for congenital muscular torticollis and metatarsus adductus, conditions which are associated with DDH[8]. The Barlow's and Ortolani's signs are useful during the neonatal period, but usually become negative by three months of age[9]. At three months old, other signs of DDH appear. The most common sign is the inability to open up the legs fully (Fig. 5).

Superior-lateral subluxation of the hip causes shortening of femur of the affected side. The shortening of the thigh causes an increased number of thigh folds compared with the other thigh, and if the hips are flexed to 90 degrees, the knee of the involved hip will appear lower than the opposite side (Galeazzi sign) (Fig. 6).

Inflammatory disorders usually present as reduced internal rotation early in clinical course, e.g. transient synovitis. Occasionally, guarding is the first sign of hip irritability, and is typically more pronounced as the clinician takes the hips toward the maximum of internal and external rotation[4].

In children less than ten years old with **Perthes disease**, loss of hip internal rotation is the earliest sign. Abduction is nearly always affected and flexion is least affected. The loss of internal rotation of the hip in children ten years and older with **slipped capital femoral epiphysis** is due to the posterior inferior slippage of the femoral head, causing the deformity similar to femoral retroversion. Examination of the hip in ambulatory patients must include an assessment of an abductor lurch by performing Trendelenburg's test. This lurch may be due to weakness of the muscles, a change in shape of the femur, or inflammation of the joint.

KNEE AND TIBIA

Examination of the knee in a child starts with observing the child for any obvious deformity. If the **genu varum** deformity is located in the proximal tibia, it may indicate tibia vara or Blount's disease. Symmetrical and entire limb deformity may indicate physiological bowing, a developmental variation. It is important to remember that most infants have genu varum, and that it gradually corrects to neutral alignment by 24 months of age. The lower extremities then gradually develop a **genu valgum** (Fig. 7), which reaches a maximum between three and five years of age. After the age of five years, the genu valgum

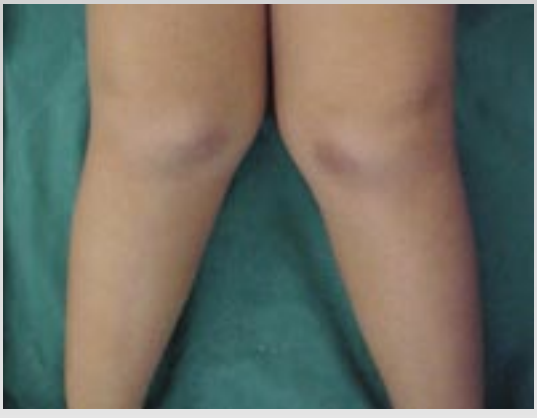

Fig. 7 Measuring the genu valgum deformity.

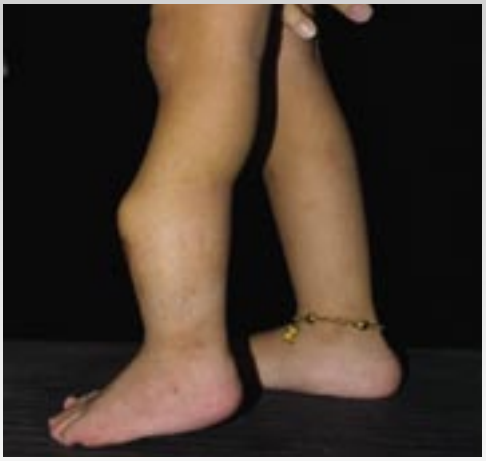

Fig. 8 Anterolateral bowing due to pseudoarthrosis of the tibia.

gradually improves to reach the normal adult tibiofemoral alignment of 7° of genu valgum by the end of growth[10].

Tibial bowing is common and varied. Lateral bowing is common in infants and is simply a normal variation while anterior tibial bowing is often associated with fibular hemimelia. Posteromedial bowing is a rare condition associated with a calacaneal deformity of the foot and mild limb shortening. Anterolateral bowing is a serious form of tibial bowing. The bowing may increase spontaneously and fracture at its apex. This leads to pseudoarthrosis of the tibia[1] (Fig. 8).

Check the movements of the knee. Hyperextension, if associated with stiffness, is called a **recurvatum** deformity. Recurvatum occurs in spina bifida and arthrogryposis[1]. Stability and effusion in the knee should also be assessed.

FEET

Examination of the feet starts with the size of the feet. The foot and calf are smaller than the contralateral side in clubfoot and hemi-hypotrophy of lower limb. Observe the skin on the sole of the feet for signs of excessive loading. One condition that is very common in childhood is **flatfoot**. (Fig. 9)

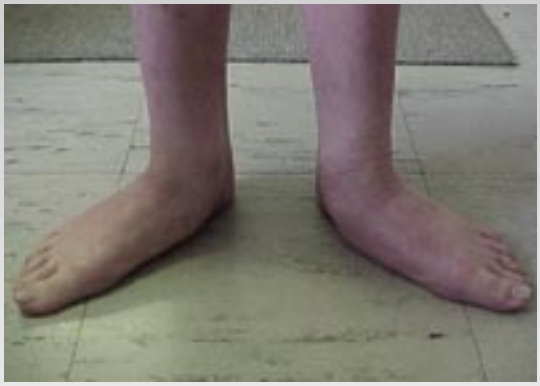

Fig. 9 The longitudinal arch of foot is not elevated during standing in flatfoot.

The longitudinal arch of the foot arch may collapse in standing but reappears when the child toe stands, a characteristic finding in flexible flatfeet. Next, examine the foot from behind for hindfoot valgus with the child standing, tarsal coalition may be present[11]. Cases of congenital vertical talus and tarsal coalition are characterised by fixed flattening of the longitudinal arch when the child toe stands[15,16]. The longitudinal arch is excessively elevated along the medial border of a weight-bearing in cavovarus foot. This may be due to Charcot-Marie-Tooth disease (hereditary motor sensory neuropathy).

Another common inherited defect in children is **clubfoot**[8]. The clubfoot is characterised by equinus of the hindfoot, inversion of the subtalar joint, and adductus of the forefoot. There is a single posterior skin crease. The calcaneus is difficult to palpate within the fatty heel pad. A complete physical examination of the child is indicated to rule out a neurogenic or syndromic cause for the deformity.

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SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME
Multiple Choice Questions (Code SMJ 200604A)

	True	False
Question 1: Which of the following statements regarding the treatment of clubfoot is appropriate?		
(a) Treatment usually starts immediately after birth.	❑	❑
(b) Initial treatment must be a surgical procedure.	❑	❑
(c) The surgical procedure commonly performed is soft tissue release.	❑	❑
(d) Untreated clubfoot causes an abnormal gait and secondary bony changes.	❑	❑
Question 2: Investigations for the rotational deformity in children include the following:		
(a) Radiographs.	❑	❑
(b) Bone scintigraphy.	❑	❑
(c) Ultrasonography.	❑	❑
(d) Computed tomography.	❑	❑
Question 3: Which of the following are risk factors for developmental dysplasia of the hip (DDH)?		
(a) Breech delivery.	❑	❑
(b) First-born infant.	❑	❑
(c) Family history.	❑	❑
(d) Male child.	❑	❑
Question 4: Which of the following statements regarding the flatfoot are true?		
(a) It may be associated with a valgus deformity of the hindfoot.	❑	❑
(b) The longitudinal arch normally develops between the ages of three and five years.	❑	❑
(c) Rigid flat foot is usually due to soft tissue structural changes.	❑	❑
(d) The majority of children with flexible flatfoot need surgery.	❑	❑
Question 5: Which of the following statements regarding tibial bowing are true?		
(a) Anterolateral bowing is frequently associated with neurofibromatosis.	❑	❑
(b) Posteromedial bowing commonly needs surgical correction.	❑	❑
(c) Anteromedial bowing is associated with fibular hemimelia.	❑	❑
(d) Diagnosis is usually confirmed using magnetic resonance imaging.	❑	❑

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