Introduction

A review of recent literature in pediatrics, pediatric orthopedics, and general orthopedics revealed a lack of information on pediatric orthopedic assessment of the newborn and infant. This paper presents a description of a 3-to-5 minute physical examination intended to detect congenital anomalies of the musculo-skeletal system, or to reassure the concerned parents that their offspring is healthy. An initial review of the family, prenatal, and birth history may alert the examiner to specific problems. Difficult vaginal labor and delivery of a large infant may cause clavicular fracture or brachial plexus injury. Breach delivery suggesting developmental dysplasia of the hip joint is one such example. Physical examination is performed from head to toe with the baby laid supine in a warm room with no direct light shining on the face. It is useful to talk throughout the physical examination.

Skin, Head, Face, and Ears

Skin

The generalized appearance of the skin should be observed. Depigmented nevi may be a sign of tuberous-sclerosis (Pinto & Bolognia, 1991). Cafe au lait spots may indicate neurofibromatosis or fibrous dysplasia (Chapurlat & Meunier, 2000; Spira & Riccardi, 1987). Hemangioma on the face or on the extremities could suggest Klippel-Trenaunay syndrome. Palpating the skin and assessing its texture provides the experienced examiner with a clue to generalized ligamentous laxity or other disorders.

Head, Face, and Ears

The fontanelle and sutures should be palpated. Premature consolidation of sutures is found in Apert syndrome (Anderson et al., 1999). The head circumference should also be measured and recorded on the child's growth chart. Hydrocephalus is characterized by an excessively large head, or a forehead that is disproportionately large, thus making the face appear small. Further characteristics include a thin scalp, distended veins, and a large anterior fontanelle, which is tense and nonpulsatile, with wide sutures.

The overall appearance of the face offers many clues to generalized disorders. Cleft lip or cleft palate is obvious. Examine the appearance, spacing, and function of the eyes, and check for ptosis or coloboma.

Deformities of the outer ear may suggest generalized disease such as Turner syndrome. These children often have a simple helix and redundant folded lobule. An elongated intertragal notch could indicate Rubenstein Taybi syndrome (Allanson & Hennekam, 1997). Check for preauricular sinuses.

Neck and Clavicle

Neck

Assess range of motion by rotating the child's head toward the right shoulder and then the left shoulder. Bend the neck laterally so that the ear approaches each shoulder. A limited range of neck motion could be associated either with Klippel-Feil syndrome (Van Kerckhoven & Fabry, 1989) or with congenital torticollis. Congenital torticollis is often associated with cranio-facial asymmetry and flattening of the face on the affected side. Amass in the sternocleidomastoid muscle is found with torticollis.

Clavicle

Palpation of the clavicles can detect a fracture that may be associated with a traumatic delivery. Local tenderness shortly after birth will soon lead to a "lump" on the clavicle as the fracture heals with abundant callus. This can also result in torticollis. Congenital pseudoarthrosis of the clavicle can be clinically diagnosed by a painless and non-tender bulbous deformity in the region of the mid-clavicle. Absence of one or both clavicles could imply cleidocraniodysostosis.

Shoulders and Elbows
Shoulders

Limited range of motion could indicate the extremely rare congenital dislocation of the shoulder, or of a more generalized problem such as arthrogryposis in which the shoulders are usually fixed in adduction and internal rotation, or of Sprengel deformity of the scapula (Leibovic et al., 1990).

Elbows

Limited range of motion could suggest amyloplasia or arthrogryposis, in which the elbows are often fixed in flexion or extension. Palpate the radial head while pronating and supinating the forearm, feeling for congenital dislocation of the radial head, or even neglected or undiagnosed Monteggia fracture. Absent or markedly reduced pronation and supination of the forearm could indicate a synostosis between the radius and ulna.

Hands

Examining the number and appearance of the fingers and thumbs may reveal syndactyly or webbing, both common findings. Hypoplasia of any element of the hand, wrist, or forearm should be noted. Poland syndrome involves brachysyndactyly of the fingers (short, webbed fingers) and hypoplasia, or maldevelopment of the chest wall on the same side. More significant deformities, such as radial club hand, show characteristic hypoplasia, or absence of the radial structures of the forearm and the hand, and can be associated with a short, bowed forearm and aplasia, or hypoplasia of the thumb. A "floating thumb" or "pouce floutant" is a small thumb with no bony attachment to the rest of the hand. Hypoplasia of the ulna and the ulnar aspect of the hand is more rare than a radial club hand. Madelung's deformity is characterized by lateral bowing of the radius with subluxation of the distal ulna, with a normally developed hand. Limited range of motion of the wrist with fixed flexed fingers and thumbs in adduction could be indicative of a neuromuscular condition, such as cerebral palsy or arthrogryposis. Symphalangism, a rare finding, is failure of joint development, with the fingers fixed in some degree of flexion. Babies' thumbs are sometimes clasped. Lack of passive or active extension of the thumbs could be a sign of either a congenital trigger thumb or clasped thumb in which there is some agenesis of the extensor muscle. Congenital amputation of fingers, particularly the fingertips, can be a presentation of congenital constriction band syndrome. Similar findings in the toes can be helpful in making the diagnosis.

Chest, Abdomen, and Birth Paralysis of the Upper Extremities

Chest and Abdomen

Note development of the chest and appearance of the nipples. Abnormalities in the chest and abdominal regions, together with brachysyndactyly, are indicative of Poland syndrome (Al-Qattan, 2001; Urschel, 2000). Observe the shape of the chest wall and contour of the ribs noting pectus excavatum, or pectus carinatum.

Birth Paralysis of the Upper Extremities

Spontaneous motion of the upper extremities as a brachial plexus injury can be detected immediately after birth. This is more common after a difficult vaginal delivery of a large infant. Erb's palsy, or injury to the roots of C5 and C6, manifests with deltoid, supraspinatus, infraspinatus injury and no spontaneous abduction or elevation of the arm, or elbow flexion, but with normal motion of the fingers. Klumpke's palsy, or an injury to the lower roots of C8 and T1, manifests with normal shoulder and elbow motion, but paralysis of the intrinsic muscles of the hand with the wrist and fingers in flexion.

Hips

The hip joint should be assessed when the diaper is removed. The Ortolani and Barlow signs, which are provocative dislocation and relocation of a dislocated hip, are used to evaluate for developmental dysplasia of the hip. Pistoning is the feeling of the femoral head sliding out of the acetabulum and into the abductor musculature. Leg length discrepancy can be indicative of a number of abnormalities, including proximal femoral focal deficiency, pelvic obliquity, dysplasia/hypoplasia of the tibia or fibula, as well as hypoplasia of the entire leg. In order to assess leg length discrepancy, the child should be lying flat and straight with the hip and the knee joints extended. The soft tissues at the heels, as well as the height of the medial malleoli, should be compared. Asymmetrical thigh folds can be noted, but are not highly correlated with hip abnormality. Flexion/extension, abduction/adduction, and internal and external rotation of the hip should be assessed.

Knees, Legs and Feet

Knees and Legs
The appearance, symmetry, and range of knee motion should be examined. Congenital dislocation of the knee manifests as hyperextension of the knee with limited flexion. Infants with this affliction are often born with their feet contiguous to the face. Congenital dislocation of the patella is manifested by lateral displacement of the patella and limited knee motion. The tibia is usually in a varus alignment due to the infant's normal intrauterine position. Anterior bowing of the tibia could be a sign of neurofibromatosis, or even congenital pseudoarthrosis of the tibia. Postero-medial bowing of the tibia presents with a significant angular deformity of the distal tibia with the foot positioned against the lower leg. Dysplasia of the fibula could be associated with bowing of the tibia, as well as valgus alignment of the ankle. The presence of a dimple on the anterior leg usually suggests a congenital anomaly. Alignment of the legs from the hips to the toes should be assessed for rotational malalignment.

**Feet**

Assessment of the feet should include evaluation of the range of motion of the ankle and subtalar joints. Snapping peroneal tendons manifest by anterior subluxation of these tendons over the lateral malleolus in dorsi-flexion and relocation on plantar flexion. Limited dorsi-flexion, or a fixed equinus position, are characteristic of congenital anomalies, such as clubfoot, or a vertical talus. Position and alignment of the heels should be noted as being varus, neutral, or valgus. A varus heel is characteristic of clubfoot deformity. The alignment of the forefoot should also be examined. Forefoot adduction may be a sign of clubfoot deformity, or metatarsus adductus. Assessment of the longitudinal arch of the feet is important. Normally the arch is decreased to absent in the infant, but a high arch could indicate a neurological problem. The number and appearance of the toes should be examined noting polydactyly (extra toes), syndactyly (webbing), overlapping of the fifth toe, or abnormal alignment of the great toe into either varus or valgus. Congenital halux valgus is rare. Constricting (amniotic) bands are often associated with foot abnormalities, such as congenital amputations of the toes or tips of the toes, and rigid clubfoot deformities.

Hemi hypertrophy of the leg may present with limb length discrepancy, enlargement of the circumference of the thigh and/or calf, and asymmetry in foot sizes. Hemangiomata on the skin may represent a developmental syndrome such as Klippel-Trenaunay. The baby should be turned onto its stomach to examine the back including the skin of the lower back and buttocks. A low hairline could be indicative of Klippel-Feil syndrome, Turner syndrome, or a web neck.

**Scapulae and Spine**

**Scapulae**

The scapulae should be palpated, checking size, location, and symmetry. In Sprengel deformity, the scapula fails to descend during development and remains abnormally high and smaller than the contralateral side (Leibovic et al., 1990). There may be an abnormal connection between the scapulae and the cervical spine known as the omovertebral bone. A limited range of shoulder motion is common. Winging of the scapula should be noted.

**Spine**

The spine should be palpated noting congenital abnormalities, or signs of spinal dysraphism. A hairy patch at the lumbar region, a sacral sinus, or hemangioma could represent an occult spinal abnormality, such as diastematomyelia or sacral agenesis (Jamil & Bannister, 1992; Miller et al., 1993). A dimple on the buttocks could also indicate a congenital anomaly of the femur. The Shochat test, in which the soles of the two feet are brought together, should be performed while the child is prone and the hips in abduction. Normally the gluteal cleft should be in alignment with the line of the contact between the two feet. Failure to realign indicates limited abduction on one side, and could be another sign of developmental dislocation of the hip. Bending the knee to 90° will enable measurement of the thigh-foot angle, as well as assist in detecting foot anomalies, such as forefoot adduction. Detection of multiple joint dislocations may indicate Larsen's syndrome (Laville et al., 1994).

**References**


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