**Introduction:**

The treatment and examination of the musculoskeletal system of the child encompasses congenital, developmental, infectious, metabolic, neoplastic as well as mechanical problems. The key to the treatment and evaluation of these children is an open mind and a thorough evaluation. The examination of children requires a friendly, comfortable environment as well as a good rapport with parents and patient. Observation of activity in addition to obtaining a history and formal physical exam in paramount in the evaluation of a child and requires patience and thoroughness on the part of the examiner. Key to the examination of the child and adolescent is a complete physical examination on every visit. Unfortunately many important unrelated diagnoses are missed for long periods of time if the physician fails to remove appropriate clothing and examine the back, skin and other portions of the body while focusing on a fairly isolated and sometimes minor problem.

**Neonates**

Each neonate should be examined thoroughly from head to toe for signs and symptoms of congenital anomalies. These are sometimes very obvious and even the least trained observer can notice them, but frequently they require closer examination. There are specific areas of the musculoskeletal system that need to be evaluated. Frequently the history of traumatic delivery accompanies specific diagnoses such as fractures of the clavicle. These children present very similar to those with congenital brachial plexus
palsy with failure of motion of the upper extremity that is pseudoparalysis. These children can be differentiated from children with brachial plexus palsy by palpitation of a tender fracture of the clavicle as opposed to children with brachial plexus injuries who may have swelling or pain with motion in the neck. Clavicle fractures tend to become pain-free within a few days. Congenital torticollis is a contracture of the sternocleidomastoid muscle, which tilts the chin to the opposite side and restricts rotation. A palpable “olive” is sometimes present in the muscle belly of the sternocleidomastoid by six weeks of age. There is a strong familial association with hip dysplasia and ultrasound of the hips in the perinatal period or a pelvic x-ray at 3-4 months is indicated. The torticollis frequently resolves with passive stretching (85%) but may require surgical lengthening if not resolved by 9-12 months of age or if progressive craniofacial deformity occurs.

**Spine**

Examination of the newborn also involves careful examination of the skin for midline skin lesions or dermal pits, which may indicate underlying bone or spinal cord abnormalities. Most significant is to look at the lowermost portion of the spine for dermal pits or skin nevi over the lumbosacral junction, which frequently indicate significant spinal cord problems such as a tether, diastematomyelia or syrinx. Also palpate the sacrum for its presence or abnormalities. Dimples, nevi, or hairy patches at any level require close evaluation. These subtle findings may help initiate treatment prior to further deterioration in neurologic status.

Examination of the hips involves gentle abduction with the hips flexed to determine whether dislocation is present (ortoloni sign). A palpable clunk in the hip indicates a
dislocation whereas stressing the hip with flexion; adduction and axial pressure will demonstrate subtle instability in the newborn period (Barlow sign). Any abnormality in the neonatal exam of the hip deserves orthopedic consultation and/or ultrasound examination. Radiographs are of little benefit in the neonatal period and are being supplanted by the ultrasound exam in experienced hands. After 6 weeks of age clinical signs of developmental hip dislocation include extra thigh folds and asymmetry in abduction and leg length. The highest ‘risk’ factors for developmental dysplasia of the hip are breech presentation, torticollis, and family history.

**Feet**

Examination of the feet may reveal rigid deformity requiring treatment early, whereas subtle deformities frequently require not treatment. All significant congenital foot problems have an associated contracture of the Achilles tendon, or absence of significant segments.

**Children**

**Torsional and Angular Development of Lower Extremities**

The great majority of children are born with their hips externally rotated from intrauterine soft tissue contracture secondary to intrauterine positioning. By the time these children are 18 months of age they begin to internally rotate their hips 60 to 70 degrees as they develop normal femoral anteversion. The total sum of internal/external rotation should normally be 90 degrees. Between 18 months and 8 years the children gradually alter this rotation and by 4 to 8 year shave typically about 60 degrees external rotation and 30 degrees internal rotation. In the neonatal period likewise there is usually a transmalleolar
axis at the ankle of 10 to 15 degrees internal with the thigh in a neutral position referred to as internal tibial torsion. By 18 months of age this typically becomes 20 degrees or more external. Children are likewise born typically with genu varum (bow legs) which becomes genu valgum (knock knees) between 18 months and 4 years with the final adult angle at about 5 years of age. There is no scientific evidence that bracing or corrective shoes have any bearing on the outcome of these torsional and angular development patterns. There is clearly no indication for corrective bracing prior to the age of 18 months for physiologic angular or rotational alignment. Progressive bowlegs however always require close evaluation and x-ray of the entire leg as this frequently indicates Blount’s Disease or metabolic bone disease.
**Septic Arthritis and Osteomyelitis**

In any child from newborn to adulthood the acute onset of fever, pain, pseudoparalysis and swelling of a joint mandates aggressive diagnostic techniques, especially joint or bone aspiration of the affected body part, to rule out septic arthritis or concomitant metaphyseal osteomyelitis. In septic arthritis the joint aspirate white blood count typically is elevated greater than 40,000 with an elevation of serum ESR and creative protein. The Peripheral WBC may be low, normal or elevated. The joint aspirate reveals primarily polymorphonuclear leukocytes and bacteria on Gram stain. The microbiology of these infections varies depending on the age of the child. In the neonate may or may not be febrile. In addition, any tenderness of the metaphysis, swelling or redness mandates aspiration of the periosteum and bone with a large bore needle. Aggressive treatment even prior to return of cultures and studies is mandated to avoid long term complications. Of significant note is that the x-ray is typically negative in osteomyelitis within the first 7-10 days after onset of symptoms. Blood cultures also vital prior to starting treatment with antibiotics.

**Hip**

The hip differential diagnosis in children from 4 to 8 with an irritable hip manifested by pain of motion of the hop joint with the hip extension and internal rotation includes not only septic arthritis but toxic synovitis, which is post viral low grade inflammatory process with minimal elevation of ESR and occasionally low grade fever that resolves with bed rest and traction. The differential diagnosis includes Legg-Calve-Perthes disease most commonly in children 4-8 years of age that is avascular necrosis of the hip as well as JRA and LYME arthritis.
Pain in the medial aspect of the thigh and knee mandate evaluation of the hip with AP and frog lateral x-rays as the obturator nerve innervates both the hip and medial thigh and knee region. This is true of all age groups. There is never an indication obtain a unilateral hip x-ray on initial evaluation as osteopenia of the involved hip may be the only sign of an inflammatory problem and will be noticed only if the opposite hip is visualized for comparison. In children 10 to 12 years of age with thigh and hip pain are frequently associated with slipped capital femoral epiphysis. X-rays both the AP and frog leg position are mandated as this is frequently noted only in the frog position and occurs bilaterally in up to 50% of patients. Aggressive urgent surgical stabilization is mandated to avoid further slippage and long term complications.

**Spine**

Children do not normally have pain in the back; thus any child with persistent back pain requires thorough evaluation. In children there is a frequent association with spondylosis and spondylolistheses which presents as low back pain. Pain which does not resolve very quickly requires not only AP and lateral spine x-rays but also a bone scan to exclude abnormalities of the para interarticularis. These may heal if treated aggressively with casting or bracing if diagnosed early. Spondylosis often is associated with spondylolisthesis which is forward slippage of the L5 vertebral body on the sacrum. This must be diagnosed early to prevent long term cosmetic and functional deformity.

**Spinal cord tumors** frequently present as tight hamstrings and back pain with progressive foot deformities. Progressive elevation of the arches may frequently indicate spinal cord pathology and requires neurological evaluation. Any child with back pain or lower extremity neurologic findings should have a standing AP and lateral full length a view of
their spine as well as a screening MRI of the entire spine from the craniocervical junction to the sacrum. These are congenital vertebral anomalies that are frequently associated with spinal cord tethering such as a midline bony fibrous spike (diastematomyelia), lipoma, or other abnormalities. Which if diagnosed early by neurologic exam and MRI scan can be surgically resected without loss of neurologic function.

Scoliosis is common, most frequently diagnosed between ages 10 and 13 years and has a nearly equal incidence of males to females. However, the majority of curves that are progressive occur in females. Approximately 5 to 10% of the population in the United States have some degree of spinal curvature. Those children with significant rotational abnormalities, that, asymmetry of the spine on the forward bend these should be referred for evaluation and x-rays. Close examination for contractures of the iliopsoas and leg length should likewise be performed at the same time as these may be secondary causes of scoliosis. The neurologic exam should also be thoroughly completed including abdominal reflexes. Pain is not part of idiopathic scoliosis and warrants further work-up. Night pain also frequently indicates tumor. Symmetrical progressive clawing and elevation of the arches may be feet caused by diffuse neurologic disease such as Charcot Marie Tooth peripheral neuropathy.
**Fractures and Dislocations**

The most important aspect of fracture management in children is recognition. Children do not typically sustain sprains. If they have any tenderness over the growth plants they should be treated as fractures and followed serially with x-ray. An epiphyseal injury may not be manifested on initial x-ray and may only become obvious at two to three weeks post injury. The only fractures or dislocations which mandate immediate reduction prior to consultation with orthopedics are those with compromised neurovascular structures. Gentle longitudinal traction followed by splinting is a safe and reliable method. No manipulation of angular deformities should be performed, however, without cognizance of the anatomy and consequences of the reduction.

This brief review is not intended to be complete and should only be used as a guideline to stimulate further reading and interest.