**Division of Orthopaedic Surgery**

**Leg Length Discrepancy**

A leg length discrepancy is a difference in size between the lengths of the legs. A small difference in leg lengths is common, many people often have a 1cm or less difference between their right and leg legs. Small differences may not cause symptoms and usually do not require treatment. However, a larger difference can cause a noticeable limp and can affect the child’s quality of life. A large difference can affect the way a child moves, making it more difficult for the child to run, play, and do activities as well as their peers and also put extra stress on the hip, knee and lower back. The bones affected by a leg length discrepancy are the femur (thighbone) and tibia (shinbone). Treatment of leg length discrepancies depend on the amount of difference, the child’s age, and presence of other deformities. Children may have a relatively small difference at birth and as they grow, the difference will likely become greater and more noticeable.

In children, bone growth occurs at the end of the bones in special areas called growth plates (physis). Growth plates are areas of cartilage located between the widened part of the shaft of the bone (the metaphysis) and the end of the bone (the epiphysis).

**Causes:**

Common causes of a leg length discrepancy include:

- Previous infections in the bone that cause growth plates to close early resulting in deformity or shortening of the limb.
- Injury or fracture of the bone, especially of the femur (thighbone), may lead to a limb difference by either becoming shortened or growing faster than the uninjured limb.
- Congenital causes such as hemihypertrophy, proximal femoral focal deficiency and fibular hemimelia.
- Bone dysplasias such as neurofibromatosis, multiple enchondromas and multiple hereditary exostoses.
- Neurologic conditions such as cerebral palsy
- Diseases that cause inflammation such as juvenile idiopathic arthritis

**Signs and Symptoms:**

Symptoms include differences between the size of the femurs (thigh bone) or tibia (shin bone) and sometimes fibula (smaller bone next to shin bone). Other symptoms include limp, walking on tip toes of shorter leg, feeling tired after walking short distances. Some patients with larger differences may experience low back pain, knee and hip pain, and early arthritis and scoliosis. Parents or caregivers are usually the first to detect a leg length discrepancy if they notice a problem with the way their child starts to walk.

What tests and imaging studies are used to make a diagnosis?

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Your orthopaedic provider will perform a physical examination. Your provider will ask your child to walk, stand and sit. To help determine the amount of difference, your provider may ask your child to walk and possibly stand on wooden blocks under the short leg to even out the hips. Your orthopaedic provider will use diagnostic imaging to help evaluate the leg length difference.

Diagnostic imaging may include:

- **X-ray**: An x-ray provides images of the affected bone.
- **Bone length/Scanogram X-ray**: This is a special x-ray that uses a ruler to measure the lengths of both entire legs from the hips to the feet.
- **CT scan**: Computerized Tomography scans provide more detail of bones of the legs.
- **MRI**: Magnetic Resonance Imaging may be used to evaluate structures such as ligaments, tendons and blood vessels and nerves.

When your child is growing, they may need routine follow-up appointments every six to 12 months to determine if the difference is increasing.

**Treatment:**

Treatment depends on many factors such as the amount of the leg length difference, the age and development of the child and the cause of the discrepancy.

Nonsurgical treatments are recommended for patients with minor limb length discrepancies. This includes monitoring through follow-up appointments and repeated imaging studies until the child is older. If your child is having symptoms, your provider may recommend wearing a shoe lift. A shoe lift can be fitted to the inside or outside of the shoe. If recommended, this may help to balance out the child’s walk and relieve some discomfort.

Surgical treatments are recommended for larger differences or deformities. Surgeries are designed to either slow down or stop the growth of the longer leg or lengthen the shorter leg. Your provider will discuss the advantages and disadvantages of each type of surgery based on your child’s individual needs.

**Guided Growth (Epiphysiodesis)**

Guided growth surgery (epiphysiodesis) is a relatively simple same-day surgery to slow down or stop the growth of the longer leg to allow the shorter leg to catch up. The procedure is performed through very small incisions on the side of the knee. The surgeon will either use metal plate to hold the growth plate temporarily or scrape out the growth plate to stop the growth. This allows the shorter leg to catch up. The surgery needs to be appropriately timed when the child has enough growth remaining to allow the shorter leg to catch up. The goal is to reach an equal leg length by the time the child is done growing. If metal plates are used, they will be removed once the correction is achieved or they are no longer needed.

**Limb Shortening**
If the child is done growing and has a leg length discrepancy, shortening of the longer leg may be recommended to even out the limb lengths. During this operation, the surgeon removes a piece of bone from the longer limb and applies plates, screws, or rods to allow the bone to heal back together. This can affect the muscles of the leg and is not used very often.

**Limb Lengthening**

Lengthening is often the preferred method as it allows your child to reach their full height. Limbs can be lengthened by devices that are either visible from outside (external fixation) or are completely inside of the body (intramedullary rods). Both forms of lengthening take advantage of the body’s natural ability to grow bone. With both types of lengthening, the surgeon cuts the bones in half with special instruments that do not injure the tissues surrounding the bone. This helps to preserve the bone covering (periosteum) that will help make new bone as the bone ends are slowly stretched millimeter by millimeter through either the external or internal device every day until the goal is reached. The body fills in the gap between the two bone ends with new bone, correcting deformities and increasing length. After reaching the desired length or correction, the device remains in place until the bone fully hardens or consolidates. After the bone has hardened, the device is removed. The entire process can take a few months to complete. Regardless of the type of lengthening, it is important to be compliant with rigorous physical therapy to avoid joint stiffening or contractures as the bone is lengthened and the surrounding muscles need to stretch to accommodate the new length.

For external lengthening and deformity correction, a frame called an “external fixator” is used to lengthen and/or straighten the bone. This is the traditional method of treatment and has been used successfully for many years. After the surgery to separate the bone, a frame is anchored to the bone and skin through pins and wires. Patients are provided a customized lengthening schedule generated by the computer and are taught to turn the dials of the six struts on the external fixator according to the schedule. Each turning of the strut increases the space between the bones and allows new bone to slowly form. Pins and wires need to be cleaned and care for throughout the duration of the treatment.

Lengthening can also be accomplished through a device within the bone called the PRECICE- Internal Lengthening Device (Nail) which has a magnet on the inside. This type of special nail is inserted into the intramedullary canal (center) of the bone through a small incision under anesthesia. The affected bone is separated with the help of an External Remote Controller (ERC). The patient holds the ERC unit on the skin directly above the implanted device and pushes a button to control the lengthening for approximately 3 to 4 minutes, 3 to 4 times a day.
Amputation Reconstruction

If a limb is substantially shorter and cannot be safely lengthened, your surgeon may recommend an amputation reconstruction and prosthetic fitting. Your surgeon will work closely with your orthotist and prosthetist to create a custom, highly functional prosthesis.

Follow Up Care:

Regardless of the treatment, regular follow up care is needed to ensure your child rebuilds strength, flexibility, and coordination. Your child’s recovery and quality of life are our NUMBER ONE priority. We may recommend that your child be seen in our multidisciplinary Limb Lengthening and Reconstruction Center. Our Limb Lengthening and Reconstruction Center is a convenient way for your child to be evaluated by our Orthopaedic Surgeons, Rehabilitation Physiatrists, physical therapist, nurses, clinical nurse specialist, social worker, child life specialist and other advanced health providers all in one visit. Physical therapy with both inpatient and outpatient rehabilitation services can be arranged to support your child’s needs. We will work together to create a plan to best support your child reach their highest level of function, comfort, and mobility.